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Major Natural Regions

Herbertson after Fifty Years

Herbertson Memorial Lecture

L. DUDLEY STAMP

IT WAS IN THE AFTERNOON of February 29th, 1904, that Dr. A. J. Herbertson read his paper entitled "The Major Natural Regions: An Essay in Systematic Geography" at what we should now call a Research Meeting of the Royal Geographical Society. It would be difficult to cite any other single communication which has had such far reaching effects in the development of our subject. Its point of view is now fundamental to the teaching of geography in almost every country of the world: it is equally basic in the progress of research in a dozen different fields.

It is instructive to look carefully at the paper itself and the response it evoked. It should be a lasting comfort to any bold young pioneer who feels his efforts are unappreciated to note what happened to Herbertson on that occasion. The reception accorded to his paper, when not actively hostile, damned it with faint praise. His critics included the great men of the day whose own contributions in varied fields we rightly applaud to this day—Mill, Mackinder, Freshfield, Yule Oldham and others. Hugh Robert Mill led off by saying, "I should like to ask Mr. Herbertson for what purposes he proposes to use those natural regions?" and on receiving a reply asserted, "The only classification equally suited for all purposes is that of coast-lines and degree-net." Then Douglas Freshfield, "It may be an instructive inquiry but I am rather doubtful as to its usefulness in teaching—if we wish to promote geographical education we ought not to make it more complicated than we can help." Mr. Ravenstein followed by saying, "for practical purposes they (regional comparisons) cannot act for us as guides." Halford Mackinder hoped "that the expression 'systematic geography' will not take root." The Chairman wound up by saying, "I think that Dr. Mill has expressed the general feeling of the meeting on the paper. For my own part I thoroughly agree that the foundation of geographical education should be orographical."

Poor Herbertson. I wonder how many investigators would have survived such a storm? More than a year passed before the paper was printed—it appeared in the March 1905 number of the *Geographical Journal* in small type, tucked in just before the book reviews. Small wonder that the future papers he promised in which he was to deal in

➢ Professor Stamp delivered the Herbertson Memorial Lecture at the Spring Conference of the Association at Matlock, on 26th April, 1957.

some detail with each type of natural region never appeared. Certainly all authors whose papers are 'turned down' should take courage—and persevere!

Turning now to the paper itself it is a model in more than one respect. It occupies less than six pages of type: its four maps are bold, clear and limited to essentials. First Herbertson states the problem. "In the detailed study of each continent, descriptions were applied to the various political divisions . . . separation involves much waste of time . . . How are we to go about making the more rational subdivisions?" He notes the problem of scale and then goes on to indicate his starting point. "What is the subject matter of geography? This I take to be the study of phenomena from the point of view of their distribution on the surface of the Earth, in natural groups, and not as isolated phenomena. Geography is not concerned with the distribution of one element on the Earth's surface, but with all." And so to apply this idea. "It is essential, first of all, to pass in review the areas determined by the distribution of one or other class of phenomena, before discussing the natural regions which can be outlined from a consideration of the distribution of all classes. The facts of configuration and of climate are of first importance, but the distribution of vegetation, and even of man, may also profitably be examined."

So Herbertson reviews first configuration and gives a map of the structural divisions of the world, six types of structural regions, following Suess. Then climate with a map of temperature belts and another of seasonal rainfall. In his delineation of temperature belts Herbertson used three isotherms—0° C., 10° C., 20° C. (kindly translated for us as 32° F., 50° F. and 68° F.)—those of 10° C. and 20° C. for the warmest and coldest months, that of 0° C. for the coldest. In thus stressing annual range of temperature and thinking in Centigrade Herbertson was far ahead of his day—and even of ours. Similarly his stress on seasonal distribution of rainfall rather than the familiar annual total was new, as was the specially prepared map. "Combining these," he continues, "we have the following climatic regions.

(1) Polar, where the temperature is never high and the rainfall always low, most falling in the summer.

(2) The cool temperate belt, with (*a*) a rainy west coast and (*b*) a less rainy east coast—both with rain at all seasons, the maximum falling in autumn or winter; and (*c*) an internal area of great extremes of temperature, and a low and early summer rainfall.

(3) The warm temperate belt with (*a*) winter rains in the west and (*b*) summer rains in the east. (*c*) The intermediate internal region, where it occurs, is one of great extremes of temperature and low rainfall, especially where mountainous.

(4) The western tropical deserts, with great ranges of temperature, and little or no rainfall.

(5) The inter-tropical regions, with one rainy season in summer.
(6) The equatorial rainy areas, with two relatively drier periods.

The mountain areas partly help to define the limits of these regions, and partly to introduce zones with successively colder climates and, up to a certain level, with wetter ones.

It will be seen from the map that most of these regions occur two or three times in each zone, and accordingly give the data for valuable comparisons."

At this stage two comments may be made. First Herbertson remained, as we do so much today, under the influence of classical tradition and uses "Tropical" and "Temperate". Secondly, he details his climatic regions which are not the same as his natural geographical regions.

Vegetation is dismissed in five lines but with the apposite comment that "the vegetation map may be looked upon as a commentary upon and a summary of the climatic one." As Professor H. J. Fleure has commented in a previous Herbertson Memorial Lecture, Herbertson came later to recognize the vegetation as an index of the total environment, as indeed he had done earlier in *Man and his Work* (1902).

Herbertson was writing in the middle of the Edwardian era when the belief was widespread that never again would Western nations engage in armed combat, yet he says, "Hitherto it has been customary to study the geography of the World according to political divisions. These, expressing the most complex and comparatively unstable of human conditions, must be eliminated from any consideration of natural regions."

So we come to the climax of the paper—the map of natural regions here reproduced and the description which must be allowed to speak for itself.

"A natural region should have a certain unity of configuration, climate and vegetation. The ideal boundaries are the dissociating ocean, the severing mass of mountains, or the inhospitable deserts. As a rule, save in the case of the shore, the boundary is not at all well marked, but the characteristics of one region melt gradually into those of another. Premising that the lines on the map are taken as the approximate central lines of the transition areas, we may divide the world up into the following types of natural regions:

(1) Polar.
  (a) Lowlands (Tundra type)
  (b) Highlands (Ice-cap type)

(2) The cool temperate regions.
  (a) Western margin (West European type)
  (b) Eastern margin (Quebec type)
  (c) Interior lowlands (Siberian type)
  (d) Interior mountain area (Altai type)

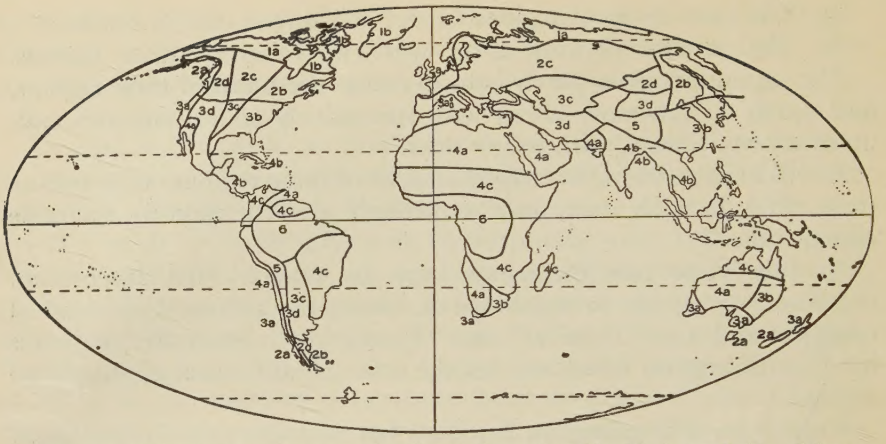

Fig. 1.—Herbertson's major natural regions. Reproduced by kind permission of the Royal Geographical Society.

(3) The warm temperate regions.
  (a) Western margin with winter rains (Mediterranean type)
  (b) The eastern margin with summer rains (China type)
  (c) The interior lowlands (Turan type)
  (d) The plateau (Iran type)
(4) (a) The west tropical deserts (Sahara type)
  (b) East tropical lands (Monsoon type)
  (c) Inter-tropical tablelands (Sudan type)
(5) Lofty tropical or sub-tropical mountains (Tibetan type)
(6) Equatorial lowlands (Amazon type)."

In view of the reception given to Herbertson's paper, what is so surprising at first sight is the rapidity with which his ideas spread, so that within a few years they came to dominate the teaching of geography in all progressive schools. But, as Herbertson states in his paper, he was presenting to the Fellows of the Royal Geographical Society a summary of ideas and methods which he had found so helpful with his own students.* Undoubtedly it was through them and his Oxford lectures that the new gospel spread. This was not plagiarism: it is natural that the receptive student mind should seize upon the better ideas of the professor, and, almost unconscious of origin, he will apply them in his teaching and use them in the elementary text books he is very likely to produce.

Since so much of the influence exercised by Herbertson was through his own text books it is important to follow there the development of his ideas. *The Oxford Geographies* wherein he sought, according to his preface, to combine the physical and political geography previously separated and unrelated, consisted of three books—Preliminary, Junior and Senior. The Senior began bluntly and unequivocably

* In *Man and his Work* (1902) he was already using six main types of environment: cold and hot deserts, temperate and tropical grasslands, temperate and tropical forests.

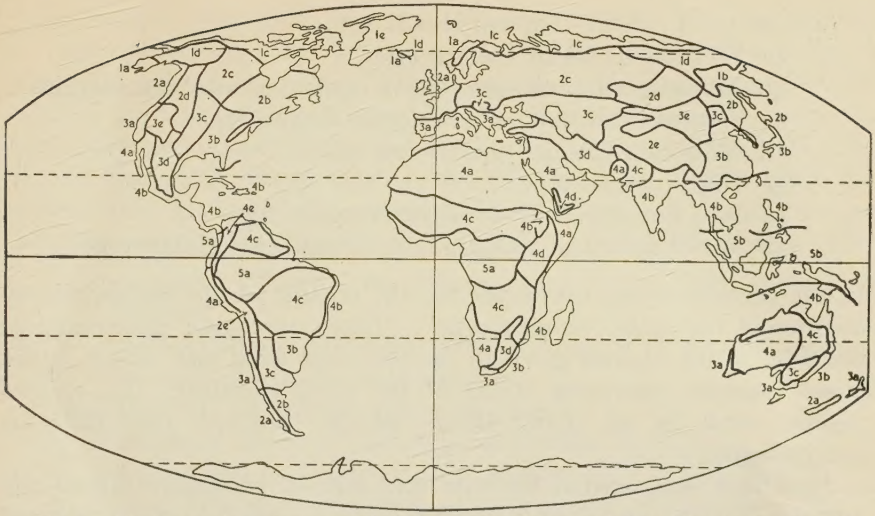

Fig. 2.—Herbertson's major natural regions as finally amended by him. Reproduced from *The Senior Geography* by kind permission of the Clarendon Press.

with sixteen pages on "The Natural Regions of the World". In the first edition of 1907 the regions are the same as in his Royal Geographical Society paper, with some small differences in names and regrouped into four—polar, cool temperate, warm temperate and the hot lands. Two years before his death in 1915 Herbertson published in *Scientia* a revision of his original scheme. The fifth edition of *The Senior Geography* is dated 1926, and was revised by O. J. R. Howarth, who states in his Preface, "the present edition includes Professor Herbertson's amended division of the World according to Natural Regions", with a new series of maps. His scheme had thus become:

(1) Polar Types
- 1a Norway type
- 1b Kamchatka type
- 1c Tundra type
- 1d Yukon type
- 1e Greenland type (ice cap).

(2) Cool Temperate Types
- 2a Western margin, or West European type
- 2b Eastern margin, or St. Lawrence type
- 2c Interior lowlands, or Siberian type
- 2d Interior highlands, or Altai type
- 2e High plateaus, or Tibet type.

(3) Warm Temperate Types
- 3a Western margin, or Mediterranean type
- 3b Eastern margin, or China type
- 3c Interior lowlands or Turan type
- 3d Plateau or Iran type
- 3e Plateau with cold winters, or Mongolian type.

(4) and (5) Types of Tropical Hot Lands
- 4a Western desert or Sahara type
- 4b Monsoon summer rain type of eastern or southern margins
- 4c Summer rain type of interior or Sudan type
- 4d Moderate plateau type of east Africa
- 4e High plateau type
- 5a Wet Equatorial lowland, or Amazon type
- 5b Wet Equatorial mountainous islands, or Malay type.

In the accompanying text types 1a, 1b, 1c and 1d are not separately mentioned but only "tundra type". There are slight differences in the titles of the regions given in the text, but what one notices is the trend towards separating tracts of the earth's surface, i.e., unique regions, such as 4d (East Africa) or 5b (Malaya and Malayan archipelago).

This book was written for boys and girls of secondary school age and the descriptions of the natural regions are accordingly in general terms. No exact figures are given for either temperature or rainfall. There are general rather than detailed references to vegetation and agricultural crops.

Thus it is broadly true that the last revision of his natural regions which Herbertson carried out before his death is less specific than his initial scheme. It is as if "natural" regions cannot be confined within exact lines mathematically defined.

It may be that for this very reason Herbertson's regions were quickly being taught in a wide range of schools. I was taught Herbertson's regions through "notes" dictated by a live Headmaster, though our text was Thornton's *Physical Geography* (first published in 1896). When, a quarter of a century later, I revised Thornton, my main addition was a section on Natural Regions.

A geologist by training, I fell into the writing of geographical text books almost as accidentally as I fell into geography itself. On my appointment to the newly created chair of Geology—which had Geography added to it to meet a popular demand—in the University of Rangoon in 1923 I found the absence of text books in the schools prevented the students coming up to the University from having an adequate background training. As a result my wife and I started to remedy this state of affairs in the primary schools, next in the middle schools, and then in the secondary or high schools. When I came to write *The World* Herbertson's natural regions were so much a part of my thinking that they were included—as I saw them—automatically. But I had been influenced by taking botany as an undergraduate and reading Schimper with great care, and by researching on the ecology of Burma. I realize now that my regions are primarily of natural vegetation.

In the first edition of my *World* geography which was thus written in 1926 (published 1927) for the schools of India and Burma, I find I was quite definite in saying, "There are only twelve important types of climate in the whole world and . . . so clear is the connection between vegetation and climate that it is often simpler to name the climate after the characteristic vegetation . . . the two in their turn control the animal life, man and his activities." We were not afraid then of determinism and of talking about "control". My twelve climates were:

(1) Equatorial climate, or climate of the hot wet Evergreen Forests.
(2) Tropical climate, or climate of the Savanna or Tropical Grassland.
(3) Monsoon or summer rain climate.
(4) Hot desert or Sahara type of climate.
(5) Temperate desert or Iran type of climate.
(6) Mediterranean or winter rain climate.
(7) Warm Temperate Oceanic or China type of climate.
(8) Cool Temperate Oceanic or rain at all seasons climate.
(9) Cool Temperate Continental or Grassland climate.
(10) Cold Temperate climate or climate of the Coniferous Forests.
(11) Arctic or cold desert climate.
(12) Alpine climate.

These are, in fact, the Herbertson regions, altered by an emphasis on vegetation and slightly away from the logical reliance on the Zones, though the classical tradition dies hard as one finds in the continued use of "temperate".

In the intervening thirty years I find my own consciousness has evolved and in the 14th English edition of *The World* (1955) the wording has been somewhat changed and in the Fourteenth (1954) and Fifteenth (1956) Editions of Chisholm's *Handbook of Commercial Geography* I used the map here reproduced (Fig. 3).

(1) Equatorial or hot wet climate (2) Tropical or Sudan type of climate (3) Tropical Monsoon or summer rain climate (4) Hot desert or Sahara type of climate	Climates of Low Latitudes or the Tropical Zone
(5) Mediterranean or winter rain climate (6) Mid-latitude desert or Iran type of climate (7) Mid-latitude Continental or Grassland climate (8) Warm Temperate East Coast margins	Climates of Mid-latitudes or the Temperate Zone
(9) Cool Temperate Oceanic or rain at all seasons (Deciduous Forest) climate (10) East Coast margins (11) Cold (Coniferous) Forest climate (12) Arctic or cold desert (Tundra) climate (13) Alpine climate	Climates of High Latitudes

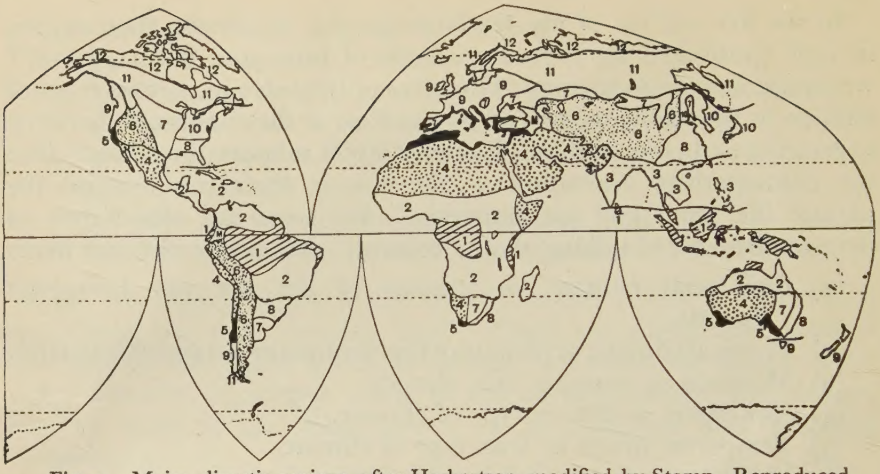

Fig. 3.—Major climatic regions, after Herbertson, modified by Stamp. Reproduced from *Chisholm's Handbook of Commercial Geography* by kind permission of Longmans, Green & Co. Ltd.

I may be cynical but experience has taught me that papers on methodology in learned journals have little effect on teaching unless they are made "required reading" by students and then the influence is still slight. But let an Examining Body put a new phrase in a syllabus: still better (or worse) let the examiners put a new type of question at what we now call Ordinary Level and it is possible to change the teaching over half the country in a matter of twelve months. Produce a good text book, acceptable on other grounds, embodying the new ideas and the change is complete. We do not realize the power of the teacher's word on a boy's or girl's receptive mind. In 1910 my headmaster fired my imagination by dictating that the tundra was characterized by "short, sharp summers." I used that phrase for forty years before someone suggested to me that a "sharp" summer was a strange expression. May teachers take note and beware the words they use!

The great influence exerted by Herbertson, his disciples and imitators, especially through school text books, did not extend to any extent to the United States. There has, in fact, been little exchange between the two sides of the Atlantic below the graduate level. The American concept of major regions stems primarily from the mathematically interpreted climatology of Wladimir Köppen of the University of Graz, first published in 1918. He defined six main zones and eleven climates so that his climatic regions are on the same general scale as Herbertson's. His scheme* is (see Fig. 4):

A. Tropical Rainy Climates
   1. Hot damp primeval forest climate
   2. Periodically dry savanna climate

* There are various modifications, see e.g., B. Haurwitz and J. M. Austin, *Climatology*, New York, 1944, Frontispiece; also later writings of Köppen himself.

Fig. 4.—Climatic regions of the world after Köppen. Reproduced from *Chisholm's Handbook of Commercial Geography* by kind permission of Longmans, Green & Co., Ltd.

B. Dry Climates
   3. Steppe climate — S
   4. Desert climate — W
C. Warm Temperate Rainy Climates
   5. Warm climate with dry winters
   6. Warm climate with dry summers
   7. Damp temperate climate
D. Sub-Arctic or Boreal Climates (Cool Snow-Forest Climate)
   8. Cold climate with wet winters
   9. Cold climate with dry winters
E and F. Snow Climates
   10. Tundra climate — ET
   11. Perpetual frost climate — EF

Although Köppen actually gives his climates descriptive names, sometimes based on vegetation, the fact that he defines them by certain arbitrary limits for temperature and rainfall has resulted in a poor correlation with observed vegetation—especially in the monsoon lands of Asia.

Two lines of development have followed on the Köppen idea. One has been the successive or evolutionary classifications introduced by C. W. Thornthwaite—first in "The Climates of the Earth" (*Geographical Review*, vol. 23, 1933) and later in "An Approach toward a Rational Classification of Climate" (*Geographical Review*, vol. 38, 1948)—who sought to determine critical limits significant to the development and distribution of vegetation. Actually the map of climatic types shows still less correlation with vegetation than does Köppen's.

The other development has been the modification and simplification of Köppen's mathematically determined climatic regions by G. T.

Trewartha. The use of Trewartha's scheme in his own widely used text books (first in *Elements of Geography* with V. C. Finch in 1936), in various atlases, including the Atlas of World Maps prepared for the United States Army (Army Service Force Manual M.101, 1943) and its adoption by numerous text book writers (e.g., L. E. Klimm, O. P. Starkey and N. F. Hall, *Introductory Economic Geography*, 1937 *et seq.*) have meant that Trewartha has exercised an influence in America comparable with that of Herbertson in Britain. Trewartha, like Herbertson in his later work, allowed himself to be influenced by observed vegetation.* In the third edition of *An Introduction to Climate* (1954, 1st edition 1937) he explains fully (page 234) how he deviates from Köppen, and distinguishes the following regions (see Fig. 5):

A. Tropical Rainy Climates
   1 Tropical Rainforest.
   2 Tropical Savanna.
B. Dry Climates
   3A Low Latitude Steppe.
   3B Low Latitude Desert.
   4A Middle-Latitude Steppe.
   4B Middle-Latitude Desert.
C. Humid Mesothermal Climates
   5 Mediterranean.
   6 Humid Subtropical.
   7 Marine West Coast.
D. Humid Microthermal Climates
   8A Humid Continental—long-summer phase.
   8B Humid Continental—short-summer phase.
   9 Subarctic.
E. Polar Climates
   10 Tundra.
   11 Ice Cap.
H. Undifferentiated Highlands.

The essential and obvious result of Trewartha's modifications of Köppen is to bring his scheme and his actual regions very close to those of Herbertson.

Other schemes have been developed by American workers. For example T. A. Blair (*Climatology, General and Regional*, 1942) gives Köppen and Thornthwaite and then develops his own scheme as follows:

T. Humid Tropical Climates
   TR. Tropical rainy climates

* In a personal letter to me of 7th March, 1957, he says, however: "I distinctly do *not* think of my climatic map as being a natural regions map. It is a climatic map only. I recognize that there is some rough coincidence between the distribution of climates and those of vegetation and soils, but this does not make it possible, I believe, to represent natural regions on one map."

Fig. 5.—Trewartha's modification of Köppen's climatic regions. Adapted from Trewartha.

TRe Equatorial Sub-type
TRt Trade Wind ,,
TRm Monsoon ,,

ST. Subtropical Climates
STS Low latitude Steppe
STD Low latitude Desert
STH Humid Subtropical
STM Mediterranean (Dry subtropical)

I. Intermediate Middle Latitude Climates
IS Mid-latitude Steppe
ID Mid-latitude Desert
IM Humid Marine (West Coast)
IC Humid Continental
ICw Warm (long summer)
ICe Cold (short summer)
ICm Modified Continental Subtype

SP. Subpolar
SPT Taïga

P. Polar Climates
PT Tundra
PI Ice cap

Mountains

In order to give teachers some guide to the many systems of major regional divisions which had grown up, the Geographical Association more than 20 years ago appointed a committee to study the problem and to prepare a report. The Committee consisted of Professors J. L. Myres, P. M. Roxby, J. F. Unstead and myself. Our Report occupies some 30 closely printed pages of *Geography* (vol. xxii, 1937, pp. 253–282)

and for it I had prepared a series of world maps all on the same scale and the same projection (equal area divided) and as far as possible using the same symbols showing the schemes used by Herbertson (original 1905 and revised 1913), Köppen, Hettner (1930 and 1934), Schimper, Passarge, Huntington, Unstead, and my own modification of Herbertson. In addition we examined and briefly described the early work of systems of regional divisions other than climatic. Since this paper is readily available I do not propose to repeat information which is so easily accessible but to refer particularly to developments since we wrote in 1937, which was in fact the year of publication of Trewartha's simplification of Köppen which was not of course available to us.

We did not in our review of 1937 mention the world climatic regions published by Professor Austin Miller in the first edition of his *Climatology*, published in 1931. Miller gives reasons for basing his scheme on "The Climatic Provinces of Supan" (1896) familiar through Bartholomew's *Atlas of Meteorology*. Incidentally Miller does not even mention Herbertson. Miller has continued to work on the problem and has recently provided some very valuable ideas and material.[1] As he rightly says, a "classification of geographical climates should:

(i) bear some relation to the distribution of the major formations of natural vegetation and to the agricultural potentialities of the land;

(ii) be so simple that the place in the classification of any station could be determined by a rapid inspection of the readily available data."

He notes the tendency of both Köppen and Thornthwaite towards attainment of precision rather than simplicity. His first map measures aridity in five stages—arid; semi-arid; sub-humid; humid; perhumid. His second map uses the important temperature of 43° F. (6° C.) first stressed by Schimper as so important in the plant world, being the temperature above which vegetative growth is normally active. By taking the number of months with a mean temperature above 43° F. and one division where all months are above 64° F. (17·8° C.) he gets:

No month above 43° F.	= Polar	= Ice
1–2 months above 43° F.	= Arctic	= Tundra
3–5 „ „ „	= Cold	= Taïga
6–11 „ „ „	= Cool Temperate	= Deciduous forest
12 „ „ „	= Warm Temperate	
All months above 64° F.	= Hot	

In his third map he gives accumulated temperatures in month–degrees above 43° F. Miller does not attempt in this paper to combine his maps to produce regions but in linking his climatic studies closely

Fig. 6.—Austin Miller's climatic types. Adapted from Austin Miller.

with known requirements of plants he is in the true Herbertsonian tradition.

Miller's classification is given, with his permission, by F. J. Monkhouse in his *Principles of Physical Geography* (Fig. 160) (1954) with the following brief description (see Fig. 6):

A. Hot Climates (mean annual temperature exceeding 70° F.)
   - 1 Equatorial, double maxima of rain
   - 1m Equatorial (monsoon variety)
   - 2 Tropical, marine: no marked dry season
   - 2m Tropical, marine (monsoon variety)
   - 3 Tropical, continental: summer rain
   - 3m Tropical, continental (monsoon variety).

B. Warm Temperate (or Sub-tropical) Climates (no cold season, i.e., no month below 43° F.)
   - 1 Western margin (Mediterranean): winter rain
   - 2 Eastern margin: uniform rain
   - 2m Eastern margin (monsoon variety).

C. Cool Temperate Climates (cold season of one to five months below 43° F.)
   - 1 Marine: uniform rains or winter maximum
   - 2 Continental: summer maximum of rain
   - 2m Continental (monsoon variety).

D. Cold Climates (long cold season of six or more months below 43° F.)
   - 1 Marine: uniform rain or winter maximum
   - 2 Continental: summer maximum of rain
   - 2m Continental (monsoon variety).

E. Arctic Climates (no warm season, twelve months below 50° F.)

F. Desert Climates (less than 10 inches of rain annually)
   1 Hot deserts: no cold season, no months below 43° F.
   2 Mid-latitude deserts: with cold season, one or more months below 43° F.
G. Mountain Climates.

On the whole it is probably true to say that botanists have concerned themselves more with floristic regions and the plants by which each unique region is characterized than with vegetation or bioclimatic regions in the geographer's sense. Thus Ronald Good in the second edition of *The Geography of the Flowering Plants* (1953) deals with the former at great length but contents himself in the latter field by redrawing Herbertson's diagram from his *Outlines of Physiography* (2nd Edition, 1907) to show the relationship between vegetation zones and altitude and latitude. But just as Herbertson laid firm foundations for the concept of major natural regions by geographers, so A. F. W. Schimper had in his *Pflanzengeographie* (English translation 1903–4) for the botanists. Works like P. W. Richards's *Tropical Rain Forest* build on this foundation.

In a pioneer work insufficiently known in Britain, despite its imperfections in its present form, J. Papadakis[2] has attempted to get away from regions based upon either a mathematical interpretation of climatic statistics or on an interpretation of natural vegetation to one of "agricultural climates."

Climates are classified on four bases.

I. According to "winter hardiness" (a mistranslation of *rigor del invierno* or *rigueur de l'hiver*): *Pr* too hard for winter wheat; *Ti* sufficiently mild for winter wheat; *Av* sufficiently mild for winter oats; *Ci* sufficiently mild for citrus; *Tp* completely frostless; *EC* means annual minimum above 59° F. (15° C.).

II. According to summer heat and duration into: *P* too cool for wheat; *Tr* sufficiently warm for wheat; *M* sufficiently warm for maize; *G* sufficiently warm for cotton.

III. According to the annual hydric index (annual rainfall/water need) into: *D* desertic ·00–·09; *XX* polyxerophytic ·09–·22; *Xs* xerophytic dry ·22–·44; *Xh* xerophytic humid ·44–·66; *Ms* Mesophytic dry ·66–·88; *Mh* mesophytic humid ·88–1·32; *H* hygrophytic 1·32–2·64; *HH* polyhygrophytic above 2·64.

IV. According to the seasonal distribution of the hydric index: *Me* Mediterranean, winter is the rainier season; *Is* ischygrous, winter is not the rainier season, but hydric index is higher in spring than in summer; *Mo* monsoon, hydric index is higher in summer than in spring, or, if temperatures are uniform all the year round, there is a decidedly dry season.

The idea behind this classification is interesting, but the first results shown in the map have many anomalies.

There seem to me to be two major obstacles to the closer *rapprochement* of climatologist and botanist. One is the inadequacy, indeed the wrong approach used, of climatic observations. The Stevenson screen isolates the instruments in artificial conditions, deliberately away from the disturbing influence of vegetation at a height—5 feet—*above* that which affects most herbs and growing crops and *below* that important to forest trees, and especially fruiting trees. The development of micro-climatological studies such as those of Geiger, especially of conditions *within* various types of vegetation as well as the study of soil climates and the climate at varied levels within a forest are getting away from this.

The second lack is of extensive surveys of existing vegetation—botanical surveys of the type Henri Gaussen is producing so magnificently from his laboratory at Toulouse. This is, of course, a plea for a world land-use survey since land use over so much of the world is of natural or semi-natural vegetation. At the same time descriptions of vegetation are subjective and lack precision. Many years ago I pleaded for the counting and measuring of the individuals per square metre (ground vegetation) or per hectare (tree and shrub storeys) and suggested a 'vegetation formula'.[3] The suggestion has recently been revived by C. S. Christian and R. A. Perry.[4]

What, we may ask, are the main results of this survey of the fifty years since Herbertson's original paper to the Royal Geographical Society? First, the concept of the major natural region is almost universally accepted as of basic importance.

Second, the original approach by Herbertson of regions basically climatic linked with vegetation is the right one.

Third, that the development of mathematical precision in definition of climatic types has led away from 'natural' regions to artificial types.

Fourth, that the search for climatic limits, notably the temperature of 43° F. (6° C.) of direct significance in the growth of plants, is work in the right direction.

Fifth, that a 'natural region' is essentially a bioclimatic region in which the plant cover is the index of the sum total of climatic conditions.

Sixth, that the immediate need is a world-wide survey of vegetation, having a greater precision in the description of vegetation than has hitherto been attempted—which is part of the objective of the World Land Use Survey. Then and only then can precision be given to bioclimatic regions.

In the meantime the modified Herbertsonian regions retain their validity.

REFERENCES

[1] "Three new climatic maps," *Trans. Inst. Brit. Geographers*, no. 17, 1951, pp. 13–20. See also A. A. Miller, "Climatic requirements of some major vegetational formations," *Advancement of Science*, vol. vii, 1950, pp. 90–4; *Climatology*, 8th edition, London, 1954; and *Proc. International Geographical Congress*, Washington, 1952 (1957).

[2] J. Papadakis (editor), *Agricultural Geography of the World* (climate, growth-rate and rhythm, vegetation, soils, crops, agricultural regions), Buenos Aires, Nahuel Huapi 4,984, 1952.
[3] L. D. Stamp, "Vegetation formulae," *Journal of Ecology*, vol. 22, 1934, pp. 299–302.
[4] C. S. Christian and R. A. Perry, "The systematic description of plant communities," *Journal of Ecology*, vol. 41, 1953, pp. 100–5.

Other books and articles mentioned in the text:

A. J. Herbertson. "The major natural regions; an essay in systematic geography," *Geographical Journal*, vol. 25, 1905, pp. 300–12.
A. J. Herbertson. *Outlines of Physiography*, An introduction to the study of the earth. 2nd edition. London: Ed. Arnold. 1907.
A. J. and F. D. Herbertson. *Man and his Work*. An introduction to human geography. 1st edition. London: A. & C. Black. 1902.
A. J. and F. D. Herbertson. *The Oxford Geographies. Vol. III, The Senior Geography*. 1st edition. Oxford: Clarendon Press. 1907. 5th edition, revised by O. J. R. Howarth, 1926.
J. G. Bartholomew and A. J. Herbertson (A. Buchan ed.). *Physical Atlas. Vol. III, Atlas of Meteorology*. Edinburgh Geographical Institute. 1899.
T. A. Blair. *Climatology, General and Regional*. New York: Prentice Hall, 1942.
R. Geiger. *The Climate near the Ground*, trans. M. N. Stewart and others. 2nd printing revised. Cambridge, Mass.: Harvard Univ. Press. 1957.
R. Good. *The Geography of the Flowering Plants*. 2nd edition. London: Longmans. 1953.
W. Köppen. "Klassifikation der Klimate nach Temperatur, Niederschlag und Jahreslauf," *Petermanns Mitteilungen*, vol. 64, 1918, pp. 193–203 and 243–8.
A. A. Miller. *Climatology*, 1st edition. London: Methuen. 1931.
F. J. Monkhouse. *Principles of Physical Geography*. 1st edition. London: Univ. of London Press. 1954.
P. W. Richards. *The Tropical Rain Forest*. An ecological study. Cambridge: University Press. 1952.
A. F. W. Schimper. *Pflanzengeographie*. English edition, *Plant-Geography upon a Physiological Basis*. Oxford: Clarendon Press. 1903.
L. D. Stamp. *The World*. A general geography. 1st edition, 1929. 14th edition, 1955. London: Longmans.
L. D. Stamp and S. Carter Gilmour. *Chisholm's Handbook of Commercial Geography*. 14th edition, 1954. 15th edition, 1956. London: Longmans.
A. Supan. *Grundzüge der Physischen Erdkunde*. Leipzig. 1896.
C. W. Thornthwaite. "The climates of the earth," *Geographical Review*, vol. 23, 1933, pp. 433–40.
C. W. Thornthwaite. "An approach toward a rational classification of climate," *Geographical Review*, vol. 38, 1948, pp. 55–94.
John Thornton. *A Primary Physical Geography*. 1st edition. London: Longmans. 1896.
G. T. Trewartha. *An Introduction to Climate*. 3rd edition. New York: McGraw Hill. 1954.
G. T. Trewartha and V. C. Finch. *Elements of Geography*. 1st edition. New York: McGraw Hill. 1936.

The Changing Arable in the Chilterns 1875–1951

J. T. COPPOCK

THE MOST NOTICEABLE CHANGE in the aspect of the English countryside in the past eighty years has been the variation in the amount of land under the plough. The early 1870's marked the culmination of a period of high farming, when arable land was widespread and when corn-growing was the main activity of farmers over large areas. Thereafter, competition from the mid-latitude grasslands and the needs of a growing population with a rising standard of living gradually shifted the emphasis in farming from corn to livestock, and from tillage to grass. The period is thus one of rapid change in agricultural land use, and, for the first time, statistical data are available which permit analysis not only of the situation at any one time, but also of the rates of change in different areas. For while changes in the demand for and prices of agricultural products induced changes in land use throughout the country, the degree of change varied from place to place. In the broad view, such differences reflect primarily differences in climate; but in any climatically uniform area, there are equally marked differences due to the soil. This paper examines such changes in relation to soil conditions in the Chilterns and surrounding areas.[1]

Soils[2]

Soils have been mapped for only a portion of this area, and no soil map has yet been published. For this reason the map and discussion are based on parent materials. Furthermore, the Chilterns are much dissected, and most of the soils of the area are derived from drift. The resultant pattern of soils is thus very complex, and any summary must be highly generalized.

The central feature of the map (Fig. 1) is the drift-mantled Chiltern plateau, stretching from the Goring gap in the southwest to the Hitchin gap in the northeast. The soils here are derived for the most part from Clay-with-flints, and typical chalk rendzinas are found only on the steep escarpment. On the flat surfaces of the plateaux soils are mainly stony, heavy to clay loams, though at lower altitudes an admixture of Eocene and early Pleistocene material lightens texture. In places, too,

➤ This article is based on part of a paper read by Mr. Coppock, who is Lecturer in Geography at University College, London, at the Annual Conference of the Geographical Association on 3rd January, 1957. Fig. 5 is reproduced from Publ. No. 20, *Transactions of the Institute of British Geographers*, by permission of the Editor. The cost of extracting the data on which Figs. 4, 7 and 8 are based was met by a grant from the Central Research Fund, University of London.

soils are almost stone-free and are derived from what appear to be high-level brick earths. Where the plateaux give way to the dry valleys, soils are stonier and more clayey, and since the Central and Western Chilterns are both higher and more dissected than the Eastern, there is a contrast between more clayey soils to the west of the Gade and more loamy soils to the east. Locally, Eocene outliers and patches of gravel give soils of much coarser texture, and eastwards the glacial sands and gravels of the Hitchin gap mark the transition to the East Anglian Chalky Boulder Clay plateau.

Along the southeastern margin of the Chilterns is a belt of coarse gravels. They are very variable in texture and give rise to a variety of soils, though these are generally coarse-textured and inclined to be very freely drained. To the northwest of the Chilterns, immediately below the escarpment, is a belt of free-working soils (shown white on the map), derived from the Middle-Lower Chalk and the Upper Greensand.[3] It has been called the Icknield Loam Belt, and is of variable width, being widest in south Oxfordshire and north Hertfordshire, and narrowest in Buckinghamshire. It has a discontinuous counterpart south of the Chilterns on the lower terraces of the Thames and the drift-covered Chalk within the Henley loop. Most of these soils are medium loams, though north of the Chilterns texture becomes heavier away from the escarpment.

None of the soils so far described is very heavy in texture, and artificial soil drainage is rarely found. By contrast, the majority of soils lying to the northwest and southeast of the Chilterns are heavy and frequently ill-drained, especially where they are low-lying. Those to the north are derived from both solid and drift deposits, from the Gault, Kimmeridge and Oxford Clays, and from Boulder Clay, which covers much of these outcrops. South of the Chilterns, the parent material of most of the soils is London Clay. All these soils are heavy; but in both areas patches of lighter soils occur. To the north, the limited outcrops of the Purbeck and Portland Beds and of the Lower Greensand all produce lighter soils, as do the patches of glacial gravels; most of these lighter soils are associated with higher ground, and downwash lightens the texture of the clay soils below. To the south there are similar gravel cappings on most of the hills.

There is thus a broad contrast in texture and drainage between the relatively well-drained soils of the Chilterns and their immediate environs, which are, on the whole, of medium to light texture, and the heavy, ill-drained soils of the adjacent claylands. These differences are reflected in workability. The soils of the Chilterns and their fringing loams and gravels are relatively easy to work and are usable at most times of the year, though the numerous flints, while promoting soil drainage, do cause heavy wear and tear on implements; the clays are mainly "four-horse" land, and cannot be used for most of the winter.

Accompanying these differences in texture are differences in fertility.

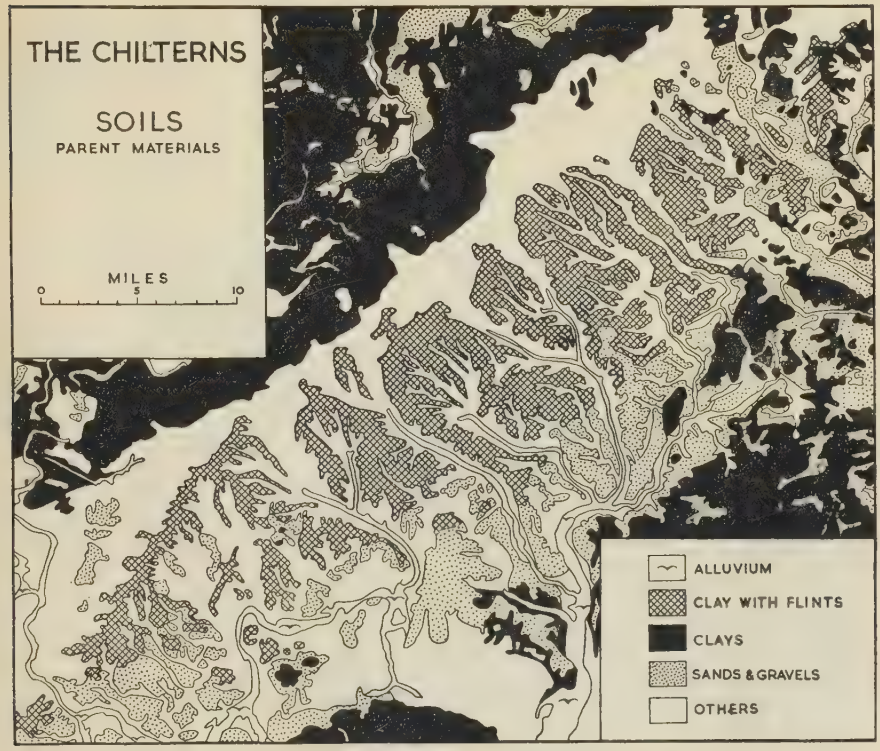

Fig. 1.—Based on Geological Survey and G. D. Nicholls.[4]

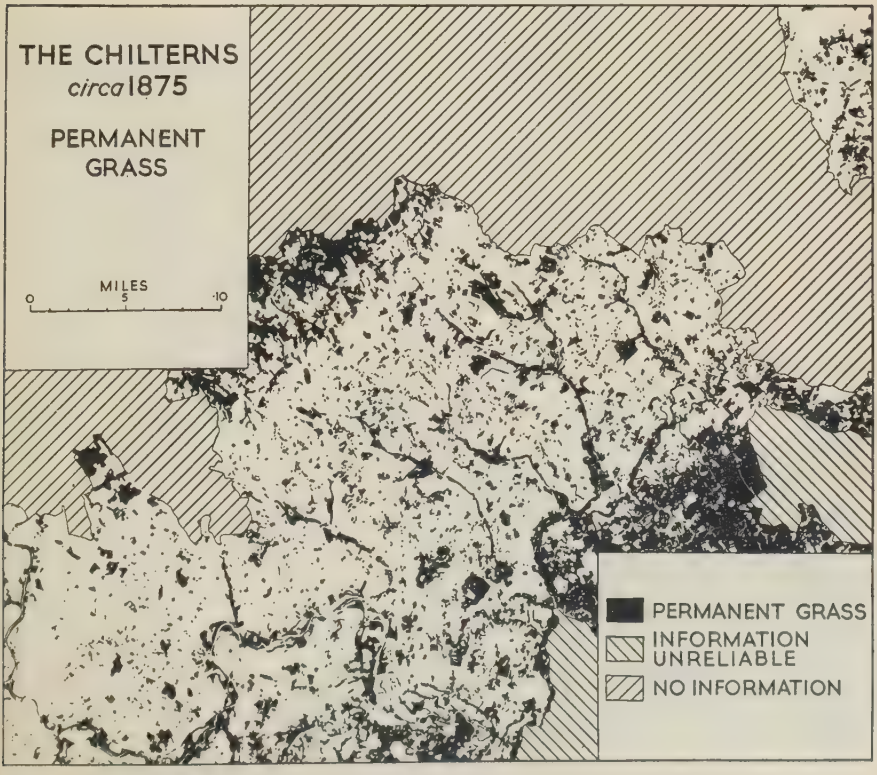

Fig. 2.—Source: Area Books, Ordnance Survey 1865–80.

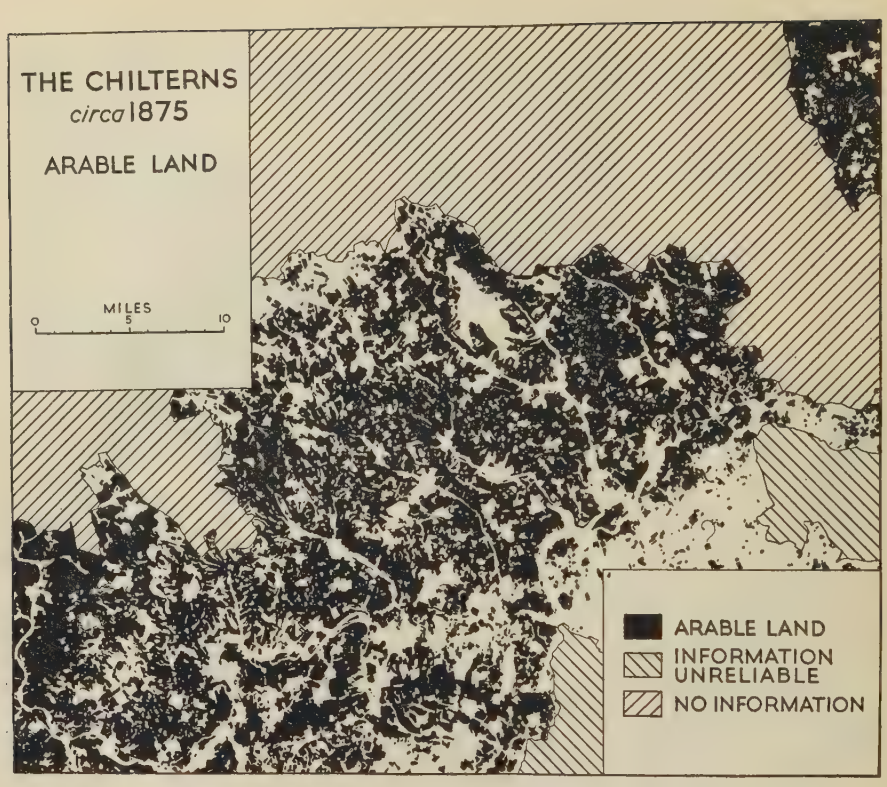

Fig. 3.—Source: Area Books.

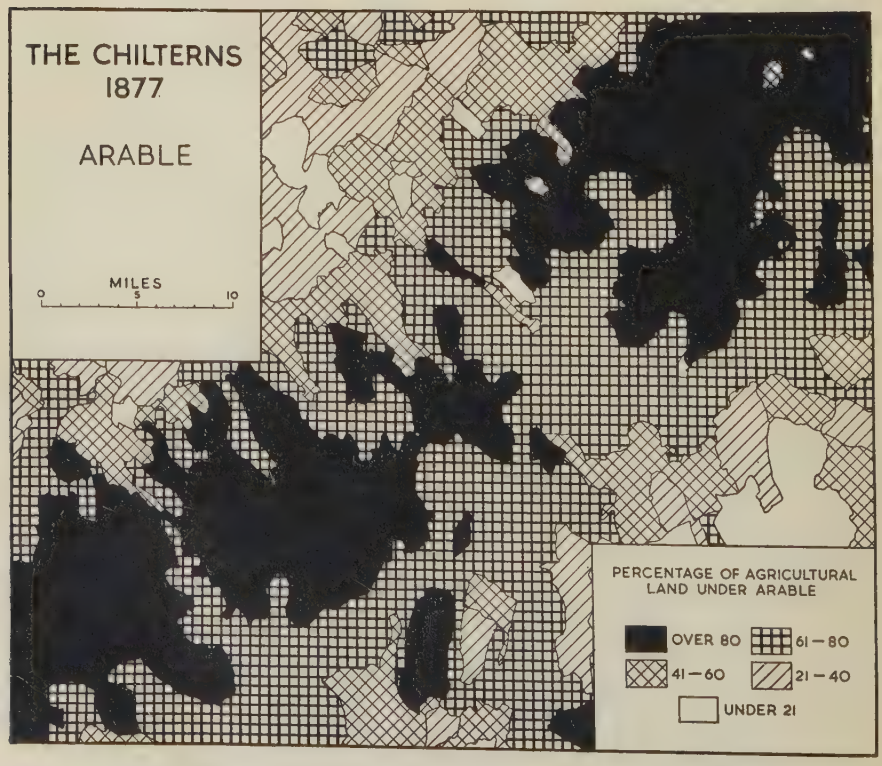

Fig. 4.—Source: unpublished parish summaries of agricultural returns.

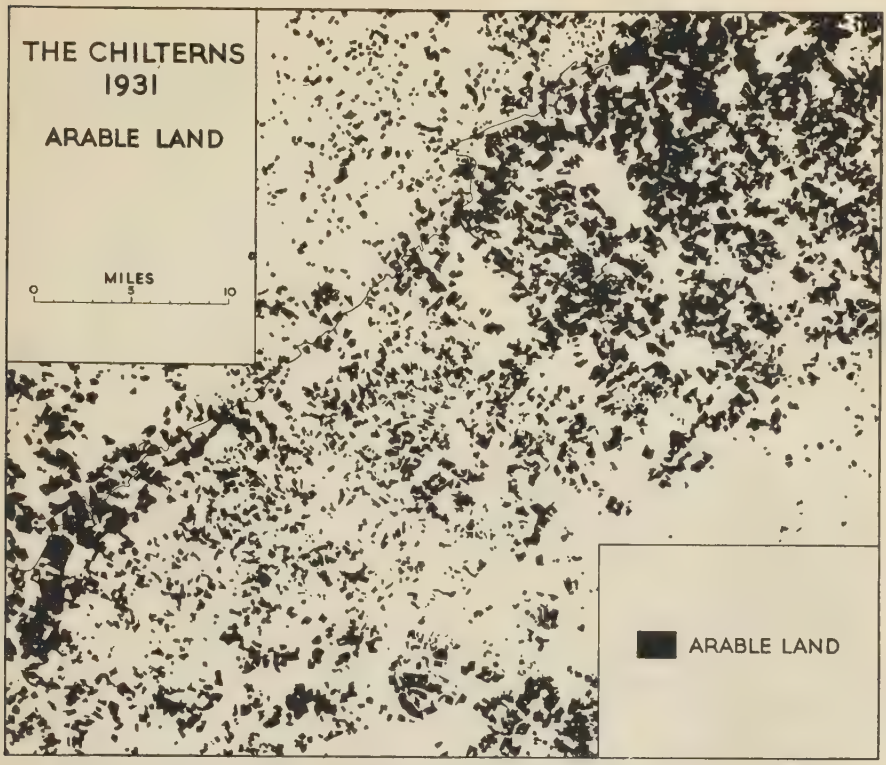

Fig. 5.—Source: Land Utilization Survey.

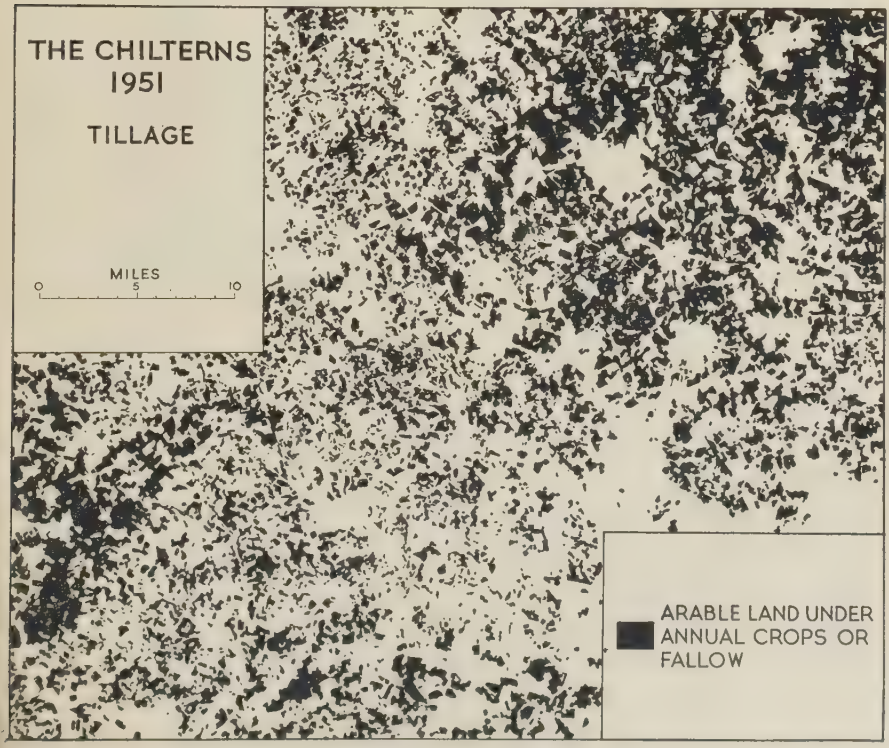

Fig. 6.—Source: University College Survey.

Only the Chalk and the upper part of the Gault give soils of high base status, and many of the other soils are deficient not only in lime but in other plant nutrients. In general, the clays and loams give, or are capable of giving, higher yields than those of the Chilterns, while the sands and gravels are less fertile.

These soils have, of course, been much modified by cultivation. Those in the Chilterns have benefited from heavy chalking in the nineteenth century, while those of Hertfordshire were much improved by heavy dressings of London manure. The effects of chalking have, however, largely worn off, and the supply of dung has ceased. Soils of the clay-lands have similarly benefited from improvement through drainage, though much of this was neglected in the years of depression.

Land Use in the 1870's

In the Chilterns in the 1870's more than four-fifths of the agricultural land was arable, and on the Icknield belt and the Thames terraces the proportion was even higher (Fig. 3). The gravel belt was also largely arable, but elsewhere to the south of the Chilterns, little land was under the plough. To the north the amount of arable land was more variable; in some areas, as around Bletchley, more than three-fifths of the farmland was arable, while in parts of the Vale of Aylesbury the proportion was less than a fifth; a figure between these two extremes was, however, more typical (Fig. 4).

The distribution of permanent grassland is complementary to that of the arable (Fig. 2). In the Chilterns permanent grass was almost entirely confined to accommodation fields around farms, to narrow strips along the few streams, and to the grounds of ornamental parks. To the south, on the London Clay, grass predominated; some of this was associated with parks, but all-grass farms were common, their land use dictated by the market for hay offered by London as much as by their soils. To the north, grass was widespread on the fattening pastures of the Vale of Aylesbury; elsewhere the proportion varied, but the pattern was probably more fragmentary, since parks were few and the ground undulating, and it was the heavy low-lying soils which tended to be in grass.

The Declining Arable Acreage

From the late 1870's this land-use pattern began to change under the impact of the falling prices of agricultural products resulting from the rapid growth of imports. There was a steady conversion of arable to grass (Fig. 7) which was absent only in those areas already under permanent grass. The rate of change varied; it was least on the stone-free loams of the Icknield belt, in a parish such as Pirton, whose soils, combining workability and moderate fertility, were most suitable for arable cultivation. The rate of change was greatest on the heavy clays north of the Chilterns; in Stewkley, which lies mainly on Boulder Clay,

the arable acreage was almost halved between 1870 and 1900. The graph for Great Missenden, in the Chilterns, shows a rate of decrease intermediate between those of Pirton and Stewkley.

This comparison of changes in the arable acreage is, however, misleading, since in some areas, notably the Chilterns, there was a marked increase in the amount of temporary grass, which though sown as a temporary measure, remained in grass as prices continued to fall, and gradually came to be recognized as permanent. The extent of change is thus concealed, so that a comparison of the tillage area probably gives a better indication; this shows that the greatest change occurred, not on the clays, but in the Chilterns, and especially in the Western Chilterns.

This conversion of arable to grass was largely a spontaneous reaction to falling prices. When prices began to move upwards in the early years of this century, the rate of conversion was accordingly reduced, the apparent anomaly of the Chilterns being due to the reclassification of temporary grass which had been laid down earlier.

The War of 1914–18

It was not until 1918 that the Great War made any appreciable impact on agricultural land use in this area. In the first three years of the war the arable acreage showed little or no sign of increasing; indeed, in some areas it continued to fall. However, the stimulus to cereal growing provided by the Corn Production Act, 1917, and the sanction of Cultivation Orders did reverse the trend of falling arable; arable increased nearly everywhere in 1918, though the increase was only a modest one, fewer than 5 acres in every hundred being ploughed for the 1918 harvest in most areas, and rarely more than ten. No clear pattern of change emerges; the increase seems to have been greatest along the southern fringes of the Chilterns, but clays, gravels and loams alike contributed. The expansion of the arable acreage was less than was required; the official aim was to restore the position of the 1870's,[5] and the Hertfordshire Executive Committee called for the ploughing up of all land which had been laid to grass since 1872, as well as all leys which had been down two years or more,[6] a demand which would have necessitated the ploughing of between 10 to 20 acres in every hundred over most of the county. The heavy clays of South Hertfordshire presented particular difficulties, partly because of lack of arable experience on the part of the farmers, partly because of the soil; a sub-committee of the Executive Committee which examined land on London Clay in the Elstree–Totteridge area recommended that no further plough-up orders should be issued there unless requested by farmers.[7]

Inter-War Years, 1918–38

This gain of arable at the expense of grass was generally maintained as long as the Corn Production Acts were in force, though even the

stimulus of guaranteed prices could not prevent some conversion to grass. But from the early 1920's onwards the process of laying arable land to grass was resumed, and at a much faster rate (Fig. 7). The reasons for this conversion were chiefly the continued fall in agricultural prices and the growing adoption of dairying as the main farming enterprise; but some allowance must also be made in the area south of the escarpment at least, for the increasing proportion of land which was only partly used for agriculture and which was normally in permanent grass, such as golf courses and recreation grounds, or the paddocks attached to large isolated houses.

The increase in the permanent grass acreage was most marked in the Chilterns, and especially the Western Chilterns. Here conversion proceeded at nearly twice the rate it had done at the end of the nineteenth century. Even so the change is probably underestimated, for land returned as rough grazing also increased, and part, if not all, of this must have been permanent grass which had deteriorated. Furthermore, the proportion of arable under temporary grass also rose, and part of this rise is probably a concealed increase in the permanent grass acreage. Neither change, however, is likely to have had any marked effect on the rate of conversion of arable to grass, since the rough grazing acreage rarely exceeded 3 per cent of the total farmland, while the total temporary grass acreage did not increase markedly as it had done in the late nineteenth century.

In the clay areas to the northwest, conversion proceeded at a slower rate, though appreciably faster than in the 1880's and 1890's; the graph for Stewkley probably gives a truer picture of what happened, since neither rough grazing nor temporary grass was important here. The Icknield belt, the Thames terraces and the Eastern Chilterns all experienced a reduction in their arable acreage, though on a much smaller scale.

The measures adopted in the 1930's to help the British arable farmer did little to stop the conversion of arable to grass, and the arable acreage continued to fall until 1939. The Land Utilization Survey's map of the area can, therefore, be taken to represent very nearly the smallest extent of arable (Fig. 5). While on the Icknield belt eight acres in every ten were still arable, and in the Eastern Chilterns six in every ten, in the Western Chilterns the proportion had been reduced to four in ten, and on the claylands to the north, virtually all the arable had disappeared, and most of the remainder was associated with lighter soils. On the clays to the south, the little arable which had existed in the 1870's had been laid down to grass. There were thus marked differences between the proportions of arable and grass in different areas, as there had been in the 1870's; but while in the 1870's there were contrasts between the clay areas to north and south of the Chilterns and little difference between the Eastern and Western Chilterns, by the 1930's the clays were nearly all under grass, and there

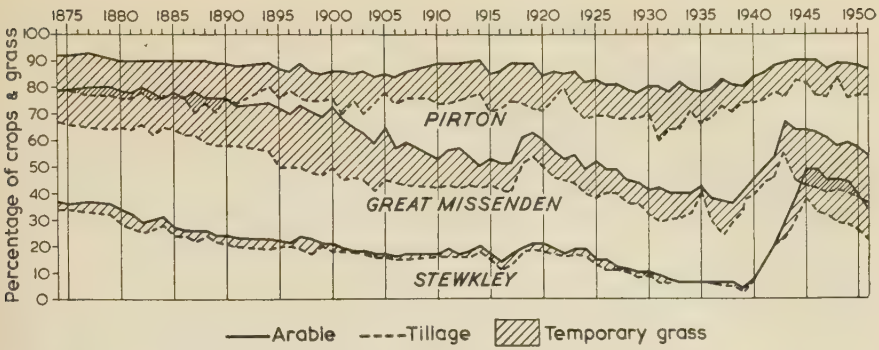

Fig. 7.—Arable and tillage 1874–1951. Source: unpublished parish summaries.

was nearly twice as much grass in the Western as in the Eastern Chilterns.

The War of 1939–45

With the outbreak of war in 1939, the trend of falling arable, which had persisted almost uninterrupted since the late 1870's, was suddenly reversed in all areas, and the arable acreage increased rapidly until 1944 (Fig. 7). The increase was greatest on the heavy clays, where between 1939 and 1944 more than forty acres in every hundred were brought under the plough. It was least in the Icknield belt, where no great increase was possible, and modest gains of ten acres of arable or less out of every hundred were recorded. The arable increase in the Chilterns ranged between ten and thirty acres, the greatest gains occurring in the west. From 1939 grants were payable for the ploughing of each acre of grass which had been down more than seven years and which was sown with an approved crop and, as in 1918, Cultivation Orders could be issued to compel the ploughing of grassland. This new arable was largely devoted to tillage crops, and the tillage acreage increased at the same rate as, or even faster than, the arable acreage (Fig. 7). By 1942, this new arable had carried two or three crops of corn or potatoes in succession, and it was often necessary to rest land by putting it under a ley. Thus, in 1943 and 1944, although the arable acreage continued to increase, the tillage acreage either ceased to expand or declined, and there was a marked increase in the amount of temporary grass, particularly in the Western Chilterns. The arable gain was thus largely the substitution of one kind of grass, admittedly more productive, for another.

The contrast between 1939–44 and 1914–18 is due to a number of causes. Compulsory powers and ploughing up grants were available from the outset in 1939, while the need for arable was much greater then because the arable acreage was so much lower than in 1914. The great contribution of the claylands was made possible by the increasing mechanization of farming and by the rehabilitation of much land by

draining and liming. Thus, while in 1918 there were only 55 tractors in Hertfordshire[8] and 14,433 horses,[9] in 1944 there were 2,374 tractors and 7,314 horses,[10] and this much greater tractive power facilitated the cultivation of these difficult soils. Drainage was improved chiefly through the rehabilitation of ditches, but mole and tile drainage were also undertaken; in Buckinghamshire, for example, 11,972 acres of heavy land were scheduled for mole draining in the early part of 1940.[11]

The Post-War Period, 1945–51

Since 1943–44 the arable acreage has declined nearly everywhere, but the change has been most marked on the clays and least on the Icknield belt. The tillage acreage has also declined, but the amount of temporary grass has remained fairly constant. To what extent this post-war increase in the relative importance of temporary grass is merely a delayed reversion to permanent grass is hard to say. Ley farming is much more common than it was, and in Buckinghamshire attempts have been made to popularize a Chiltern rotation of three years grass and three years tillage; on the other hand, Huthnance, while acknowledging the greater importance of leys in Oxfordshire, has said that true ley farming is rare.[12] All that can be said with certainty is that long leys are more common, especially in the Western Chilterns, and are likely to remain so.

There is no precise record of the location of arable at the wartime peak; but a survey made in 1951, when much of this wartime arable was still under the plough, will serve to illustrate the contrast with the 1930's. Since the identification of temporary grass in a period when reverted arable still bore the marks of wartime ploughing was no easy matter, Fig. 6 shows only those fields which were under annual crops or fallow. But while the map considerably underemphasizes the importance of the plough, especially in the Western Chilterns, it is more comparable with Figures 3 and 5 than its title suggests, for neither in the 1870's nor in the 1930's were long leys common in this part of the country. Apart from the general increase in the amount of land under the plough compared with Fig. 5, the most noticeable feature of the map is the great expansion of tillage on the clays both north and south of the Chilterns.

Net Changes 1875–1951

These changes are summarized by Figs. 8 and 9. Fig. 8 gives quantitative expression to the broad pattern of change in agricultural land use over this eighty-year period, which is apparent from a comparison of Figs. 3, 5 and 6. The reduction in the arable acreage between 1877 and 1938 was greatest in the Western Chilterns and it was least in the Icknield belt, which remained largely in arable, and in the Vale of Aylesbury and on the London Clay, which were already largely under permanent grass in the 1870's. The arable expansion between

1938 and 1944 was, however, greatest on the claylands both north and south of the Chilterns; it was naturally least in those areas where arable remained important. Thus, although the war reversed the trend of falling arable, it did not restore the land-use pattern of the 1870's. In the Western Chilterns, arable never regained its former importance, partly because of changes in the farming system, partly because of the loss of much agricultural land to housing or to semi-agricultural use. Over much of the claylands, on the other hand, arable was more extensive than it had been in the period of high farming. The effect of wartime gains has thus been to blur the contrast between the Chilterns and surrounding areas.

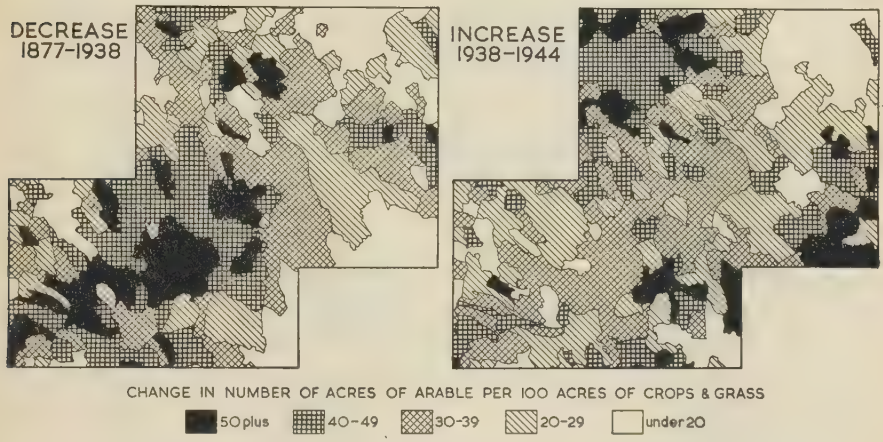

Fig. 8.—The Chilterns—arable.

Fig. 9 amplifies this broad picture by illustrating what happened in four sample areas. Ipsden, in South Oxfordshire, shows the constancy of land use on the Icknield belt; for while there is certainly less arable in 1931, it is extensive at all periods, and change has occurred primarily on the thinner soils and steeper slopes of the escarpment, and not on the broad expanse of Chalk at its foot. Shenley and Puttenham show the differences between the changes on the clays north and south of the Chilterns. Although much of the soil around Shenley is derived from gravel or modified by gravel downwash on to the London Clay below, there was little arable in 1872 compared with the widespread arable in 1951. Around Puttenham, on the other hand, there is approximately the same amount of arable in 1880 and 1951. The Boulder Clay country to the north would certainly show a much greater range of fluctuation, but unfortunately, there are no data for this area. Great Missenden illustrates changes in the Western Chilterns and shows the considerable fluctuations which occurred here; the failure to restore the 1878 arable acreage is, however, due in part to the loss of farmland to housing. The changes in the Eastern Chilterns would be intermediate between those of Ipsden and Great Missenden. It is interesting

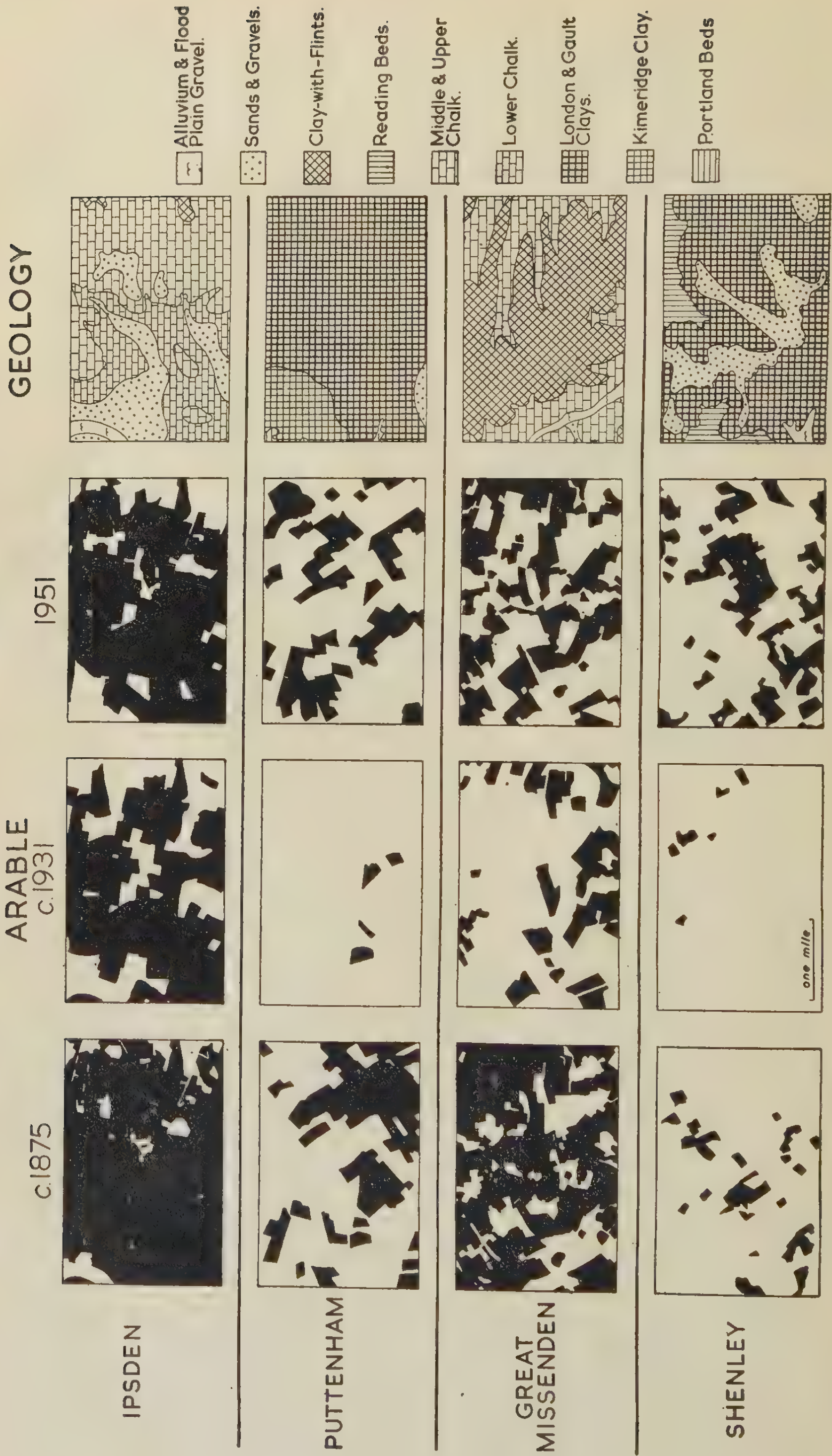

Fig. 9.—Changes in arable 1875–1951 in four sample areas.

to note that the pattern of persistent arable, though similar, is never identical at different dates.

Conclusion

It is instructive to compare these maps with the Land Utilization Survey's Land Classification Map. Professor Stamp's thesis[13] that the maximum change occurred on land of intermediate quality, and the least on both the best and poorest land receives general confirmation. The areas of persistent arable, the Icknield belt and the Thames terraces, are shown as first class or good arable land, the areas of persistent grassland in the Vale of Aylesbury as first quality grassland. The Western Chilterns, where the maximum change occurred, are classed as land of intermediate quality, while the greater persistence of arable in the Eastern Chilterns is reflected in the intermixing of good and intermediate land. There is too little poor land to assess the stability or otherwise of land use; but such as there is, the Burnham Plateau shows changes as great as those on intermediate land. Only the classification of the clay vales, where considerable change occurred, as good quality land seems open to question.

These maps and graphs emphasize how much depended on local soil conditions. Indeed, the contrasts in land use on these different soils are more marked than those attributable to climate as expressed by figures for counties on the east and west coasts. Of course, soil is not the only consideration; farm size, economic status of the farmer, tradition and personal idiosyncrasy all play a part. All serve as a reminder of the complexity of England and of the difficulty of generalizing about its geography.

REFERENCES

[1] For a description of the area, see J. T. Coppock, "Land Use Changes in the Chilterns 1931–1951", *Transactions of the Institute of British Geographers*, Publ. No. 20, 1954, pp. 113–40.

[2] This section is based on N. H. Pizer, "A Survey of the Soils of Berkshire", Dept. of Agricultural Chemistry, University of Reading, *Bulletin* No. 39, 1931, and M. S. Temple, "Survey of the Soils of Buckinghamshire", *ibid.*, *Bulletin* No. 38, 1929; on *Reports* Nos. 4, 5, 6, 7 and 8, Soil Survey of Great Britain, H.M.S.O., London, 1954–6; and on personal observation.

[3] The soils of the Middle Chalk are often thin, especially on the escarpment; but where there is a wide outcrop below the escarpment they are usually modified by downwash and drift.

[4] G. D. Nicholls, "Introduction to the geology of Bedfordshire", *The Bedfordshire Naturalist*, 1947, No. 2, pp. 9–16.

[5] K. A. H. Murray, "Agriculture", *History of the Second World War*, H.M.S.O., London, 1955, p. 9.

[6] Minutes, Hertfordshire War Agricultural Executive Committee, Herts. Record Office, 11th June 1917.

[7] *ibid.*, 7th January 1918.

[8] *ibid.*, 13th January 1918.

[9] *Agricultural Statistics of England and Wales*, 1918, Part I, H.M.S.O., 1918, Cmd 375, p. 14.

[10] *Agricultural Statistics*, 1950–1, *England and Wales*, Part I, H.M.S.O., 1954, p. 23.

[11] H. H. Nicholson, "Field Drainage and Increased Production", *Journal of the Royal Agricultural Society*, vol. 109, 1948, p. 215.

[12] S. L. Huthnance, "Farming in Berkshire and Oxfordshire", *ibid.*, vol. 110, 1949, pp. 1–2.

[13] L. D. Stamp, *The Land of Britain: its use and misuse*. 2nd edition, London, 1950, p. 64.

The Colorado River

Its Utilization by Southern California

G. PHILIP CURTI

IT HAS OFTEN BEEN SUGGESTED that the Colorado River is the "Nile of North America." The interior rain shadow area of its lower reaches depends almost entirely on it for a water supply through what would otherwise be an arid uneconomic waste. Situated in the southwestern section of the United States of America, its headwaters are able to maintain a vigorous stream flow throughout its 1,450 miles of length, by concentrating the precipitation that is available on the western slopes of the Rocky Mountain continental divide in Wyoming, Colorado, and Utah. For about a thousand miles of its course it follows a tortuous route through a progression of canyons cut in the Colorado Plateau. The Colorado flows in a generally southwesterly direction across the state of Colorado, in which it receives numerous tributaries, into the southeast section of Utah where it makes a junction with its chief tributary, the Green river, itself 750 miles long, and across the northwest portion of Arizona into the Grand Canyon.

Below Boulder Canyon, the river courses in a direction almost due south through generally level terrain along the west boundary of Arizona, adjoining the southeast boundary of Nevada, and then California. About 17 miles south of Yuma, Arizona, it crosses the international border between the United States and Mexico, through which latter country it flows for some 80 miles, before discharging into the Gulf of California.

Besides the Green river, the most important tributaries of the Colorado include the Blue, Eagle, and Gunnison rivers in Colorado; the Escalante, San Juan and Fremont rivers in Utah; the Virgin river in Nevada; and the Kanab Wash, Bill Williams Fork, and Gila rivers in Arizona. With all its tributaries the Colorado drains portions of seven states, Colorado, Wyoming, Utah, Nevada, Arizona, New Mexico and California, totalling a drainage basin area of some 244,000 square miles.

Whereas the headwaters of the system reach into areas having a precipitation of 20–30 inches annually, the lower half of the course of the Colorado river flows through a section of the United States that averages less than 10 inches of rainfall annually, and in particular, from the point where the Virgin river meets the main stream through the Arizona, Nevada, California borderlands, the precipitation varies from an occasional 5 inches a year to practically zero in the Colorado Desert.

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THE INTEREST OF CALIFORNIA IN THE COLORADO RIVER

Of the seven riparian states of Wyoming, Colorado, Utah, Arizona, Nevada, New Mexico, and California, those of the lower basin, Arizona, Nevada, and California, having areas with exceptionally low precipitation adjacent to the Colorado, have been most strident in their claims for benefits that might increase the value of their state. In California, Dr. Oliver M. Wozencraft's foresight envisaged a plan to divert Colorado River water into the Imperial Valley area, some 30 years before active irrigation was begun in the Palo Verde district in the 1870's. Since then, various projects have been commenced: the largest irrigation development in the desert area of Southern California is that of the Imperial Valley, which was initiated in the 1890's; the Coachella Valley scheme contemplated in the same plan was started in 1902; and the Yuma Federal Reclamation Project was authorized in 1904.

The long and fierce legislative battle between Arizona and California was the result of the realization that the tremendous influx of population into the southwest, together with the increased demands for further water supply for the Metropolitan areas of Southern California necessitated the search by California for further sources of water. This, not only for domestic consumption but for irrigation of the water-scarce, but fertile, food-growing areas of the Imperial and adjacent zones, became vital for survival.

THE NEED FOR WATER

California's water budget has been unbalanced for a long time. The region's rate of water consumption has been exceeding its dependable income from all sources, a process made temporarily possible by the use of accumulated water capital in the sand and gravel banks of underground storage. Since the days of the Spanish missions, sole dependence upon perennial springs during the long dry summers caused irrigation development to be sharply limited.

The long severe drought period of 1899–1904 forced Los Angeles to commence work on its Owens River Aqueduct. This completed, the stage was set for an extremely rapid growth of Los Angeles, and today there is even an extension of this sytem to Mono Basin, north of Los Angeles by 4° of latitude; but the water supply of the Owens system has never been legally available to the surrounding urban areas. These have a population equal to that of Los Angeles (over 2 million), and have a water requirement far greater, for they include citrus and other irrigated areas.

The increase in local water demands may be illustrated by the growth of the population of the coastal plain from about 3,000 in mid-nineteenth century to an estimated total resident population in the Los Angeles Metropolitan Area of over 5½ million in 1957. Even in the

mid-1920's, other sources of supply had to be found, and California looked to the Colorado River.

To support her claim, California, besides demonstrating the vital needs of her people, showed that for all practical purposes, the Salton Sea Basin, embracing the Imperial and Coachella Valleys, was a part of the natural drainage basin of the Colorado, and should be so considered. For many centuries the Colorado River flowed into and out from the Salton Basin, and the recurrence of such an event is only prevented by river regulation and levée protection. Since the waters are now used legally for irrigation and other purposes, both within and without the natural drainage basin, the Salton Sea Basin should be considered part of the drainage basin of the Colorado River.

As California's plans became known, it was apparent that unless some prior understanding could be reached with respect to the division of the waters of the Colorado, it would be difficult to secure the authorization of such a project as the All-American Canal and the Boulder Canyon Project, as a Federal undertaking. In 1922, the riparian states finally signed the Colorado River Compact, which assigned to the Upper Basin (that part of the Colorado upstream from Lee's Ferry) 7,500,000 acre-feet of water annually. A similar amount was allotted to the states of the Lower Basin, Nevada, Arizona and California. In addition, the Lower Basin was given the right to increase its consumptive use by 1,000,000 acre-feet per annum.

THE BOULDER CANYON PROJECT

The Boulder Canyon Project Act, finally passed by Congress and approved on 21st December 1928, provided for the construction of a storage dam and power plant at Boulder Canyon, and authorized the construction of the All-American Canal.

The execution of the power contracts guaranteeing repayment of capital and annual costs of the Hoover Dam* and incorporated power plant, held up construction until such time as it was certain that there would be full subscription to the project. When the bids for electric energy were opened on 1st October 1929, it was found that two of the applicants, the City of Los Angeles, and the Southern California Edison Company, had asked for all the power which would be developed at the dam, and that all together, applications had been received for more than three times the proposed amount of power available.

The fact that power must bear the cost of the Boulder Canyon Project is the result of the joint cost situation involved in a multi-purpose project. The basic objects of the plans were three-fold:

1. To provide the storage of water for agricultural and domestic use.
2. To provide river regulation and flood control on the lower Colorado.

* Sometimes called Boulder Dam; opened by President Hoover in 1933.

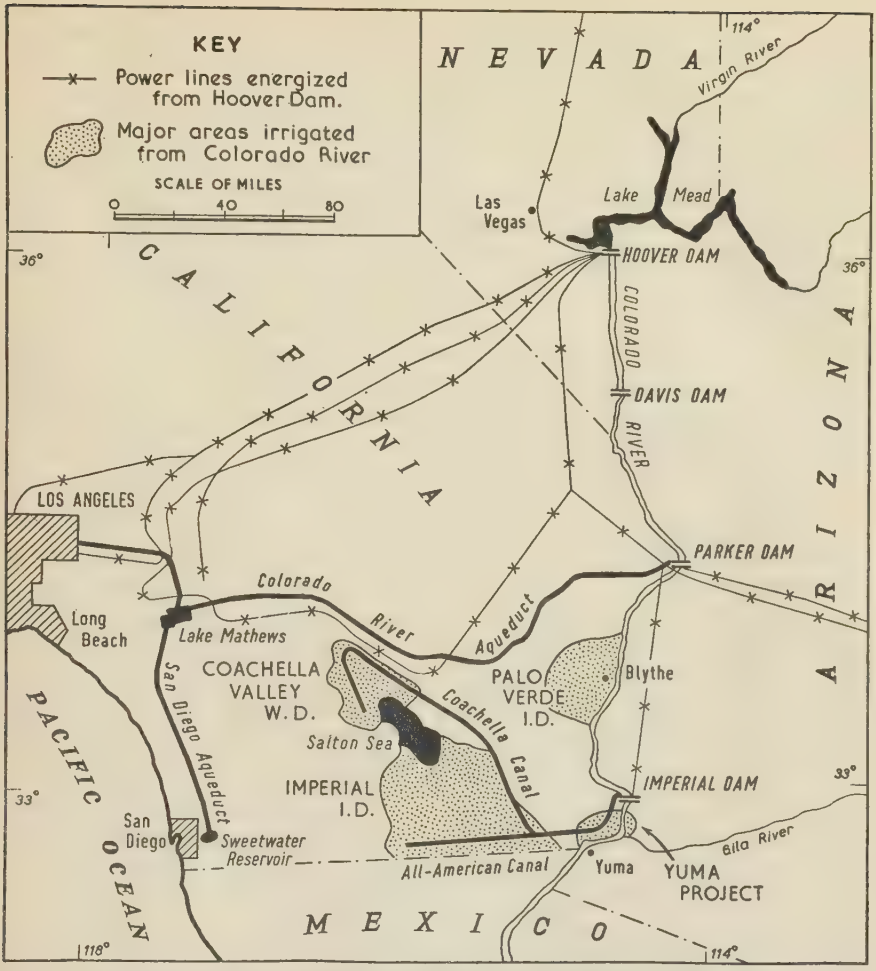


Fig. 1.—Boulder Canyon projects in California. Modified from *Hoover Dam*, Map 39–4, U.S.D.I.

3. To make available the generation of enormous quantities of electric power.

Construction work on the dam proper started in 1931, and was completed by the Federal Government in October 1936. The All-American Canal unit of the project was started in 1934, and in February 1942 commenced the delivery of all the water supply of the Imperial Irrigation District; the Coachella Branch of the All-American Canal was started in 1938 and completed for initial operation in 1946.

In continuation of the planning for the safeguarding of the water supply to Southern California, and in addition to the work undertaken by the Federal Government, the construction of the Colorado River Aqueduct was financed and undertaken by the Metropolitan Water District of Southern California. Construction of the aqueduct was commenced in 1933 and was completed in October 1939. It is 139

miles long, and is provided with its intake from the Colorado River at Parker Dam from which it accepts 1,100,000 acre-feet of water per annum for delivery to the subscribing members of the Metropolitan Water District of Southern California. The terminal reservoir of the aqueduct is Lake Mathews, which also serves as the main distribution point for the system, having an initial capacity of 107,000 acre-feet.

An extension of this aqueduct has been almost completed to serve the interest of the City and County of San Diego. To supplement its local water supply, San Diego contemplated the appropriation of some 112,000 acre-feet of water: about half of this amount is now being delivered, but in view of the population trends in the vicinity of the city, it would appear that, even after the completion of the aqueduct extension, additional supplies from other sources will have to be provided.

THE SILT PROBLEM

Few realize that the Colorado River in its natural state had an average silt content exceeded by only one or two rivers of the world. Daily tests of the water in the main canal of the Imperial Irrigation District, prior to the building of Hoover Dam, showed, on several occasions, a silt content as much as 30 per cent by volume. It was in reality the silt content of the river, rather than the quantity of the water, which created the flood problem in the lower river.

About 95 per cent of the river's silt originates above Hoover Dam, and since the dam was constructed, over a million acre-feet of silt have been deposited in Lake Mead, the artificial reservoir formed by impounding the Colorado's water above Hoover Dam. This amount is only one third of the dead storage provided for silt retention. The construction of Bridge Canyon Dam, upstream from Lake Mead, will, until its retentive capacity is replete, reduce the silt deposit in Lake Mead to a minimum. Below Hoover Dam, the works at Davis Dam and Parker Dam are designed to aid in preventing silt reaching the California projects in operation. To these, the problem of silt will always be a menace: fine silts, if carried on to project land would ruin the productivity of the soil by filling the pores and making the soil impermeable.

ELECTRIC POWER FOR SOUTHERN CALIFORNIA

The recognition that the opportunity for human habitation in Southern California depended upon adequate water supply was appreciated early, but it was not immediately understood that there would also be an equal need for adequate electric power supply. The importance of power development in the Southwest became even more obvious when it was recognized that even the water supplies for both agricultural and domestic use are largely dependent upon electric

energy. Where gravity fails, electricity is necessary to pump water over higher levels. This factor was considered when plans for the multi-purpose project were being formulated, as well as the rapidly developing industrial and domestic needs of Southern California.

At the Hoover Dam, the City of Los Angeles and the Southern California Edison Company operate the generating plant. The generating equipment is sufficient to provide enough electrical energy to meet the combined energy requirements of Los Angeles, Pasadena, Burbank, Glendale and affiliated areas, as well as the power required by the Metropolitan Water District of Southern California, the Southern California Edison Company, the California Electric Power Company and the States of Arizona and Nevada.

The firm energy output now approximates to 4 billion kilowatt hours annually. It is of vital importance that the power is low-cost and making possible the tremendous industrial expansion that is now taking place in the Southern Californian coastal region.

The Southern California Edison Company serves the greater part of ten Southern Californian counties, and of its total of 1,742,000 kilowatts generated by all its resources, 465,000 are supplied direct from the Hoover Dam generating plant. The increasing demand for electric power may be shown by the fact that whilst the population of the City of Los Angeles has increased by 35 per cent during the last decade, the demand for electric power has become 120 per cent more than ten years ago. Of the specific supply to the City of Los Angeles, 53 per cent originated at Hoover Dam. Recently, Dr. R. E. Baugh of the University of California at Los Angeles stated:

> "During a period of phenomenal economic development, power supplies have kept pace with, and even run ahead of, agricultural, municipal, and industrial demands. Ninety-six per cent of the farms in California are electrified, and the average consumption of electricity on farms in the State is more than seven times the national average."

In Southern California the tremendous industrial and agricultural progress would not have been possible without the benefits of the multi-purpose Colorado River projects.

IRRIGATION PROJECTS IN SOUTHERN CALIFORNIA

Water is the lifeblood of the arid west: the fertile alluvial soil, and the high winter and summer temperatures need but an adequate supply of water to complete the vital triumvirate for making unproductive desert into valuable agricultural land.

All the California projects for the diversion and use of the Colorado River are either completed or under construction. There are primarily four of these projects:

1. The Metropolitan Water District and San Diego Water Authority include all the coastal area of California that is to be served with

domestic water from the Colorado River at Parker Dam; the requirements are 1,212,000 acre-feet per annum.

2. The Palo Verde Project, situated around the city of Blythe, has brought into active cultivation some 55,000 acres by obtaining rights to 300,000 acre-feet of water direct from the Colorado River about 200 miles downstream from Hoover Dam. The principal products of this region are alfalfa, alfalfa seed, vegetables and melons.

3. The part of the Yuma Project in California includes lands of the Yuma Indian Reservation and lands of the Bard Irrigation District. The total developed area in the California part of the Yuma Project is 15,000 acres, whilst water has been reserved for an additional 10,000 acres, outlying the protective levées, but adjacent to the present developed areas. The estimated requirement is for 50,000 acre-feet per annum.

4. The All-American Canal, tapping the Colorado River at the Imperial Dam, serves the 800,000 acres of rich desert land in the Imperial Valley, now one of the most productive areas in the world. The Coachella Canal, an extension branch of the All-American Canal, serves 80,000 further acres in the Coachella Valley. Under present agreements, 3,800,000 acre-feet of water may be delivered to subscribers.

The Coachella Valley County Water District controls an area of 135,000 acres, north and west of the Salton Sea, and as construction of local extensions of the irrigation system is completed, further acres are brought into cultivation. While grapefruit, grapes and vegetables figure highly in production, the special product of the area is found in the ever-increasing date groves.

The suitability of the Coachella Valley for date cultivation and the marketability of dates may be appreciated from the fact that this area possesses over 90 per cent of the date grove acreage of the United States of America. The expansion of agricultural acreage in the Coachella, primarily due to the completion of the Coachella Canal in 1946, may be shown by the following sample table:

Dates in the Coachella Valley

	Total Acreage	*Production (Short tons)*	*Value*
1940	3195	6,200	$725,000
1955	4598	24,300	$7,400,000

The total value of the principal agricultural products of the Coachella Valley has increased from $1,309,507 in 1940 to the estimated 1957 figure of over $25 million.

THE IMPERIAL VALLEY

Almost entirely an arid desert in the 1880's, the area under the Imperial Irrigation District's jurisdiction is now one of the most prolific agricultural regions of the world. The advent of the All-American Canal, an improvement on the old Alamo Canal, has

transformed waterless waste into an Eden of intensified agriculture. The district has a gross area of 882,788 acres, of which 500,488 are under cultivation, and represents the largest irrigation region of the western hemisphere. The principal products are cotton, lettuce, cattle, and calves, alfalfa and sugar beets, each of these items producing over $10,000,000 in value in 1956. Lettuce is the most valuable truck crop, and it thrives in the winter months and affords supplies to the eastern markets at a time when fresh lettuce is unavailable to them from elsewhere.

As a measure of the increased values and production of two of the prominent crops of Imperial County due entirely to the availability of water via the All-American Canal, these sample figures are offered:

Imperial County
Value of Production in Dollars

	Alfalfa	*Lettuce*
1929	2,730,000	8,373,000
1956	14,216,106	16,950,853

For the same two sample years, over a span of almost a quarter of a century, the value of the acreage for the two Southern Californian counties most concerned with Colorado River water for agriculture is impressive in its increase:

	Acreage under Production		*Value*	
	1929	1956	1929	1956
Riverside	197,706	286,615	$23,033,881	$150,772,220
Imperial	318,249	457,810	$30,379,308	$118,980,876

In Imperial County, the population in the year 1910 was 13,591; in 1955, 69,390. This period approximates to the time span of the growth of the projects of the Colorado River, and reflects the effect of reliable power and water supply on what would be an otherwise unproductive waste land. We have noted the increased value in agricultural production, from some $30 million prior to 1930, to over $146 million today. To the individual farmers too, the benefits have been great: for example, for the decade 1940–50, the average annual income of the farmers of Imperial County rose 385 per cent!

If the Colorado River were once more to discharge its waters into the Salton Basin, 1,250,000 acres of excellent farm land in Imperial and Coachella Valleys would become submerged, and the counties of Imperial, El Centro, Holtville, Calexico, Mecca, Thermal, Coachella, and Indio would be covered with water.

The multi-purpose Hoover Dam project has been an inestimable boon to Southern California. Although certain problems such as that of silt are in temporary abeyance, and others, including the Mexican Water Treaty, the Gila Project, the Central Arizona Project, water allocation and budget, are still the subject of controversy, the taming of the Colorado is accomplished. The hydro-electric power and water conservation of the Hoover Dam are the backbone of a highly developed

economy which has created a valuable market for the products of farms, mines and factories of the nation.

Striding across the mountains and deserts are the steel pylons bearing the transmission lines which deliver billions of kilowatt hours of electric energy to the industries of the growing southwest. Downstream, the river offers its waters for the irrigation of thousands of fertile farms, and to millions of people in the coastal cities for domestic use. As the Koran once said of arid Arabia, so can we say of the American Southwest today:

> Water is the fount of life:
> We have made of water, everything living.

REFERENCES

Baugh, R. E., *Urban Water Supply and Water Power*, University of California at Los Angeles, Unpublished paper, 1950.

California and the Colorado River, The Colorado River Association, Los Angeles, 1954.

California: Fruit and Nut Crops, 1909–1955, U.S. Department of Agriculture and California Department of Agriculture, Sacramento, California, 1956.

California's Stake in the Colorado River, Colorado River Board of California, California State Printing Office, 2nd revision, 8th printing, 1952.

Hoover Dam, U.S. Department of Interior, Bureau of Reclamation, pamphlet, U.S. Government Printing Office, Washington, 1946.

Views and Recommendations, Colorado River, California State Department of Public Works, Sacramento, 1947.

Geography Room Survey 1957

A Report by the Secondary Schools Section

In his presidential address to the Geographical Association in January, 1956, Mr. L. S. Suggate spoke about "Aspects of Geography Teaching in the Grammar School."* Among the matters which he raised was a concern for a "survey of special geography rooms and their equipment in both old and new school buildings." Following this suggestion a questionnaire, prepared by the Secondary Schools Section Committee, was sent in February 1957 to all subscribers to *Geography*, of whom life and annual members (at the full subscription rate) of the Association were known to number then about 3,200. Many members are not teachers in Secondary Schools and so would not be concerned with the questionnaires. In some schools two or more colleagues would receive the leaflet but only one reply would be needed. The return of 578 completed questionnaires is therefore an indication of the importance which members attached to Mr. Suggate's call for an investigation. Even more convincing evidence of their concern could be seen in additional comments included in a large proportion of the replies. Members have taken

➤ Prepared by Mr. J. A. Morris and Mr. R. Cole, chairman and secretary respectively of the Secondary Schools Section Committee.

* *Geography*, vol. xli, 1956, pp. 1–14.

much trouble to describe in detail the geography room provision in their own schools and many of them also relate their problems to other aspects of school work.

Such a response made the survey very well worthwhile as a source of information both to the Association's committees and to individual members. The care taken by members to complete the questionnaire more than outweighed certain minor deficiencies in its form and it therefore becomes possible to summarize the replies fairly completely. It is however regretted that the plans of rooms which were supplied in one or two cases cannot be included in this report.

In the first instance the Secondary Schools Section Committee wished to distribute the questionnaire as widely as possible amongst geography teachers in secondary schools, but for practical reasons the circulation had to be limited; the obvious way for the Association to start was to collect information from its own members and the sample may therefore be considered to be biased. It must be recognized that the replies are from teachers who have sufficient interest in geography and its teaching to be full members of the Association and also to trouble to return the questionnaire. These people are likely to be teachers who are in schools where, often largely as a result of their own efforts, geography is a strong subject and provision for its teaching is good. On the other hand, almost any sample, however chosen, for a survey of this sort would be biased in some way.

It was assumed by the Committee that everybody would agree that special facilities are essential to encourage the best geography teaching; only one correspondent dissented in any way from this. On the paramount question of the provision of the room itself replies showed enormous variety. One of Mr. Suggate's particular fears was that new schools were being built without provision for geography or without consultation with those who would use the rooms or who could give expert advice. This fear is, unfortunately, confirmed in a number of replies. For example one teacher had been told that "Geography is a bread and butter subject; any room will do" and another says "This is a new school . . . provisions of the room are totally inadequate." Several replies stressed the urgent importance of consultation before building plans are drawn up although one correspondent admitted that "perhaps we should not have seen the snags on the plan either." In one school "a room for geography was strongly recommended at the general inspection in 1956, but the project has been shelved (expense). A similar recommendation at the general inspection in 1937 was also never acted upon." Another reference to building mentioned two new schools where no-one has asked for "any specialist advice as far as I am aware . . . regarding the Geography Room although advice has been sought regarding science laboratories."

On the other hand, there is much encouragement in a statement that "this is a new room, to be made by August 1957. Geography staff

were consulted about equipment, etc. and were given what they wanted. In addition to the 720 square feet of room there is a store room"; or "this school is possibly the best equipped in ———. It was only completed in 1952." Similarly "a new school is shortly being provided with a fully equipped and designed Geography Room and a Geology Room." Another member wrote "all specialist staff, including geography, have been asked for observations on plan and furnishing."

Even in cases where rooms have been specially equipped one's heart may bleed with the teacher whose room, as the school increases in size, "may be divided into two parts . . . for additional classrooms . . ." The room would be abolished and all its specialist equipment little used. Another writes of "an adequate Geography Room designed to my own plan with necessary modifications due to economy. On my return to school after the summer holidays the room had been divided into two by a permanent wall!" A similar case is where "inadequacy of accommodation was recognized a couple of years ago and provision was to have been made for a new Geography Room in a new extension at present being erected. However, to get and keep someone to teach physics the space was converted to a new physics laboratory." In another school the room "is shortly to be converted into a lab. Then the Geography will probably be taught in the attic." It was however admitted in this case that the attic room was quite large and adequate.

Fortunately such cases were rarely noted and it is much more comforting to hear of well-established rooms with good equipment or of the planning of new rooms to come into service in the near future. Several members noted that the recommendations of the Geographical Association* were used as a guide to planning. For example "I was asked to take a share in planning the new room and was able to get the architect to go as far as altering the original plan of the building in order to accommodate modern ideas concerning geography laboratories as suggested by the Geographical Association".

A delightful circumstance was described as follows: "We took over this beautiful room over some new almshouses, which were rebuilt, after being completely destroyed by enemy action, in September 1956. It was rebuilt exactly as it was in 1527—but it is really lovely and has been passed by the H.M.I.'s as a good room. Our observation area is, however, the churchyard! We are absolutely compact with kitchen, toilets and store cupboard."

As anticipated not all the facilities suggested in the questionnaire were welcomed. For instance rear projection screens are less used than good blackout facilities and no member called attention to this as a matter for regret. Whilst the majority of rooms have at least an 8×3 feet blackboard space, sometimes with sliding boards, the

* P. R. Heaton, *The Geography Room in a Secondary School*, Geographical Association, 1954 (2s. 6d. post free).

number of rolling boards is small. Indeed several members expressed dislike of the rolling board.

A simple but, one would hope, almost universal piece of equipment not mentioned on the questionnaire is a map bar. It is surely to be expected that any room where geography is taught regularly, and certainly any Geography Room, would be provided with this. Yet one member complained that he was having extreme difficulty in getting a bar fitted.

The questionnaire asked only about hanging globes. It is assumed that virtually all schools have some type of globe although one member does report the extraordinary circumstance of having "no globe of any sort, despite repeated pleas." A considerable proportion of schools in fact do have the hanging fixture but it was clear that its absence may be quite deliberate policy. Several replies added a note expressing support for the use of the standing globe and one bluntly stated "wouldn't have one" opposite the question on the hanging globe.

Availability of visual aids varies from an extreme case where the Head of the school disapproves of such things to a number where, often in Modern Schools, all facilities are available actually in the Geography Room. As can be seen from the tabular summary below, films, and often the film projector, are usually available on loan; filmstrip projectors and strips are in the Geography Room or at least in the school; slide projectors are less common. Episcopes are much less universally used and comments showed that their size and weight together with the need for a first-class blackout discourage their use. In this part of her reply one member noted "Facilities very good—time and energy not always available!"

Although rotary duplicators using wax stencils or multi-colour carbons are not often in the Geography Room itself they are usually available in the school. Several teachers note that they have, of course, a good range of *Mapograph* rolls. One aristocrat of Geography Rooms boasted "a tilting river profile tank" and "a land form and coast erosion tank with weirs and wave paddle."

It is hoped that members may be able to gain from this summary some conception of the varying standards at present existing. It is regretted that more information was not available from Modern Schools where so much important work is done, often by teachers not specially trained as geographers or spending their full time on the teaching of the subject. If the information obtained and here made public functions as a catalyst enabling members to achieve conditions stimulating to their teaching, the survey will have achieved one of its main purposes. We may all feel in sympathy with the member who writes: "I am delighted to have this opportunity to air my difficulties—even though I will not thereby remove them! Trouble shared is trouble halved." Another comment reminded us how much the

teacher can do: "There has always been a specialist teacher in charge of the subject . . . All have been enthusiasts and the room now has a wide range of equipment, maps, charts, books and pictures of all kinds."

It is apparent from the survey that excellent facilities do exist in places. Where provision is good it is to be expected that teachers will be enabled and encouraged to do their best work. It is hoped that any opportunity to make available the best facilities will be seized as fully as possible. Members who feel that more details from these replies would help them in their own particular problems should direct their inquiries to the Secretary of the Secondary Schools Section Committee.

SUMMARY OF REPLIES TO QUESTIONNAIRES

Figures in the first column relate only to unqualified affirmatives: those which were qualified, for very varied reasons, are noted separately (e.g., Cupboard space "almost adequate"; or "not really" room for pupils to work with Ordnance Survey maps).

	Additional qualified replies
Total number of questionnaires returned	578
Boys' schools	216
Girls' schools	192
Mixed schools	170
Grammar schools (including Public, Independent and Boarding Schools)	424
Modern schools	84
Technical schools	22
Bilateral and Comprehensive schools	40
Intermediate and Commercial schools	8
Schools with one or more Geography Rooms ..	394
Total number of Geography Rooms mentioned ..	490
(The largest number of rooms in any one school is 4; in four different schools.)	
Schools where Geography is an alternative subject ..	372
(The choices are very complex and may vary from year to year. Many replies say they are too complicated to explain.)	
Rooms in which geography is taught, including those claimed as Geography Rooms, are mentioned as being of the following sizes:	
Under 480 square feet	163
480–576 ,, ,, ...	253
576–720 ,, ,, ...	243
720–960 ,, ,, ...	114
Over 960 ,, ,, ...	29

Room facilities: One room only has been taken into account for each school. It is either the main Geography Room if there is one or the best equipped room in that particular school.		*Additional qualified replies*
Room used for other teaching or as a form base	469	11
Specially *built* or *equipped* as a Geography Room	162	47
South facing	264	43
Having access to playground	144	23
Having access to roof or observation area	80	9
(A number of schools mention the maintenance of a meteorological station.)		
Rooms with ordinary school desks	254	
Rooms with tables	313	
(The tables are dual in 192 cases. Most of the rest are single but a fair number are for three or four pupils and some for up to eight.)		
Adequate space to use O.S. maps	259	65
Blackboard at least 8 × 3 feet	393	5
Rolling blackboard	79	
Sink with cold water	184	6
Sink with hot water	63	6
Sand table	59	5
Hanging globe (slate)	154	
Hanging globe (physical)	82	
Hanging globe (unspecified)	29	
(The most common size is 19 inches. Others are mainly smaller but some are 24 inches in diameter.)		
Map tracing table	199	10
Map chest	375	26
Adequate cupboards	334	54
Adequate display boards (pin-up boards)	361	50
Adequate display facility	180	49
Adequate blackout	425	27
Rear projection facilities	116	5
Rooms with power plugs	499	3
Store room for geography use	253	39

Facilities available:

	In the Geography Room	*Elsewhere in the school*	*On loan*
Films	104	188	167
Film projectors	168	291	53
Filmstrips	351	152	38
Filmstrip projectors	339	209	4
Slide projectors	289	168	7
Episcopes	245	185	2
Duplicating facilities	98	420	2

A few other schools say that the facilities are available but it is not stated where they are located.

Geography Teaching in a Comprehensive School

A. J. HEAMON

THE COMPREHENSIVE SCHOOL in its early years is not an environment in which one may readily express a philosophy of one's subject or quickly develop ideas of teaching that subject. The beginning of the experiment in comprehensive schools is still very close and for some time to come the practical operation of the experiment will so absorb those concerned with it that impressions of trends in ideas and methods will be obscured. This article is written after eighteen months of teaching geography at Great Barr Comprehensive School, Birmingham; it is concerned mostly with the content of the syllabus and teaching method and may be regarded rather as an interim commentary and not as a statement of the results of recent experiment. There has been no conscious following of a pre-determined pattern of geography teaching.

One does not easily escape the question of size in the comprehensive school and many of the limiting factors in the organization of a subject and of its teaching derive from the need to deal with large numbers. Great Barr opened in 1955 with a fully comprehensive first year of thirteen forms (about 450 children) and second, third and fourth year forms taken over from two secondary modern schools. At first, the entry was completely streamed but this idea has already been abandoned for the first and second years in favour of four blocks, each consisting of three parallel forms. A group of children who are backward or retarded in mathematics and English corresponds to the thirteenth form. This change was made partly in an attempt to associate houses and forms but mainly because it was felt that there was no real point in such early differentiation in view of the mental development which may take place later. Thus, in all subjects, except mathematics and modern languages where sets based on attainment are formed, classes in the lower school may contain up to a quarter of the whole range of ability. This situation demands a reconsideration of the methods and syllabus content to which one is accustomed elsewhere.

The common syllabus which aims at providing a common basic training for the children is not an attempt to set a common level of attainment in factual knowledge. It is planned to teach the use of basic skills in the study of geography which are used universally, for

➤ Mr. Heamon is head of the geography department at Great Barr Comprehensive School Birmingham. The opinions expressed in his paper are entirely his own.

example, accurate observation, note-making, library research. Factual learning, instead of being the core of the work, is used primarily to illustrate and give practice in these skills. This means that children spend more time on, say, the handling of specimens and the recognition of trees than on more conventional book work. The wide range in learning rates in any one class demands a shift of emphasis to individual work which is, of course, the end for which the mastery of the skills is essential and intended. While, from the point of view of "covering ground" the rate of advance is rather slow, the children are learning to work on their own. By the end of the second year nearly all are capable of collecting information and preparing individually miniature geographical studies of a small area.

The great range of ability associated with reading and writing is not necessarily paralleled in other skills. A reduction of the emphasis on book learning in geography and the conscious development of other skills seem to produce a rapid all-round improvement in understanding at all levels of ability. At the same time, individual work gives wider scope to the brighter children whose competence in working from original sources offsets their lack of conventional book learning in the subject.

The content of the syllabus in the first two years is designed chiefly as material for the practice of techniques. It includes a good deal of observation work such as the study of trees, rocks, soils and weather. As much time as possible is spent out of the classroom on local geography and map-making. Indoors, simple experiments on movements of the earth are carried out. More conventional class work includes simple anthropology, life in the British Isles and a number of topics in physical and human geography considered in relation to sample areas of the world. These are extensive assignments and to make individual work on them possible close liaison with other departments is necessary. Many techniques of learning are common to several subjects and as far as possible the Heads of Departments agree to co-ordination and the adoption of standard practices. In geography, for example, certain methods are used in the preparation of sketch maps and these methods are also employed by the other departments which use sketch maps. Similarly, no attempt to use note-making is made until this has been taught in history lessons. In this way it is hoped to make the learning process more efficient and to minimize confusion. At the present time a beginning has been made in tackling the different and more difficult problem of correlating content so that certain basic concepts can be presented clearly and uniformly.

The points discussed so far relate mainly to the work of the first and second years which constitute the first phase of the syllabus. There seems to be no serious teaching difficulty to prevent the application of the common syllabus to the third year but at present there are

two over-riding considerations. One is the fact that the comprehensive schools, rightly or wrongly, will be judged mainly by external examination results. The other is the necessity of providing meaningful courses for those who leave at fifteen. As long as the G.C.E. Ordinary level and similar examinations remain chiefly tests of factual knowledge, the limited time available in the middle school must be devoted to factual learning.* The problem of the fourth-year leavers is the same as in any secondary modern school and at present the teaching methods in the lower school have not had time to produce results. After eighteen months' work one feels that it pays to deal with limited topics thoroughly. The second and third year children who came into the school in 1955 seemed to be tired of superficiality and glad to get to grips with work involving fairly complex causal relations. The present syllabus includes courses of termly or half-termly duration on topics like weather, elementary geology, trade and production. To the obvious criticism that such courses sacrifice the unity and meaning of the subject one can only reply that these qualities exist in the minds of the academically trained. For these children the unity and meaning are provided by the causal connections within the topics.

Definite conclusions about comprehensive schools cannot be drawn after eighteen months' work but there have been results which time may endow with significance. Unlike most comprehensive schools Great Barr began with its second, third and fourth year pupils drawn entirely from two secondary modern schools, in one of which there had been some good geography teaching. Little result can be shown from the fourth year and it was not thought wise to make any radical changes in the work of most of the third year. In fact, 25 children from the third year will probably approach, in 1958, the standard required for an external examination; 10 or 15 may be G.C.E. candidates. From the second year have come about 100 children who are likely to attain a similar standard. It must be borne in mind that Birmingham's grammar school entry is low (about 17 per cent of children attaining the age of 11) but many children find places later in the commercial and technical schools; some have left Great Barr to do this. The first year includes the selective entry and has been working on the common syllabus almost from the start. It seems reasonable to suppose that about one half of this group will be able to reach an external examination standard in geography.

At the present time, however, problems are more numerous than promises and there are several which are not peculiar to geography teaching, for example, questions concerned with records and examinations. Under any system of administration, paper work must inevitably be a considerable burden in any Department in a school

* The Associated Examining Board is, however, showing the way to a much needed reform in this respect.

of 2,000 pupils. It can be minimized with a fully specialist team of teachers but without that, records which are up to date and of the right kind are a vital necessity. One must ensure that information about individual weaknesses is passed from one teacher to another so that they can be remedied as far as possible. Equally, a late developer needs to be watched and transferred without delay. Departmental records, therefore, should contain, as a minimum, notes of the child's effort and attainment relative to both his form and his year and remarks on special difficulties or aptitudes in, for example, deductive exercises or map reading.

Individual record cards provide the greatest continuity but they take rather a long time to complete and sort—a serious disadvantage, since records are also required by the school office and form teachers. Form lists have so far proved a satisfactory alternative. They have the theoretical disadvantages of being discontinuous and giving less room for comment but in practice these have not been serious difficulties. Moreover, it is often useful to make direct comparisons between children in the same form.

Obviously, with the methods of teaching used in the lower school there is considerable restriction of what can be tested by the traditional type of examination and where one year alone produces 450 scripts, marking which will allow fair comparison is a major problem. Objective tests, in which answers are reduced to a phrase selected from a number of possibles or to a single word, have been used to overcome these difficulties. In the particular circumstances these have several advantages. They are easy to mark and even though several examiners are involved the results are strictly comparable. They also give less weight than essay examinations to verbal ability and consequently are a fairer test of geographical reasoning and knowledge. The results of these tests are converted to deciles to allow comparison between individual results in different years. Written examinations are set to groups of forms and assessments are made of practical work and individual projects so that a fairly complete record is built up. Generally speaking there is a fair correlation between the examination results in the other main school subjects and the tests. This indicates their reliability as criteria of attainment in geography.

It was felt desirable in a comprehensive school to remove as far as possible the distinction between examination and non-examination groups. The question of an internal certificate for leavers at fifteen is under discussion. This examination would be externally assessed though set by the Heads of Departments. Provided that the examination were adjusted to a planned syllabus, and not the other way round, it would be an admirable conclusion to the semi-vocational courses which are already in being. In geography it would take the form of short problems based on specified pieces of evidence plus a practical test of map-making or the preparation of statistical diagrams. Once

the standards of the examination were recognized in Birmingham generally, holders of the certificate would have advantages when applying for posts.

Arising, like most of these problems, from the size and diversity of the school is a practical detail which merits attention. When I compare the syllabus which I have prepared for Great Barr with that of the grammar school in which I previously taught, I am struck by the rigid and specific character of the former. This may seem surprising considering that one aim of the common syllabus is to promote individual work. At the outset I was bound to be specific in order to make my intentions clear to a rather large group of teachers who were non-specialists and were occupied with the subject for only part of their time. A contributory difficulty at present is the great variety of text-books in use. These were inherited from the former secondary modern schools and are still employed for lack of money to re-equip the school completely. It is to be hoped that time will overcome these difficulties. In a very large school, however, a permanent factor operates: because of transfers and exigencies arising from the timetable it will seldom happen that a child is taught by one geography teacher for more than a year. It is essential, therefore, that the methods of teaching the various techniques and the order in which they are tackled should be specified. Much as I would wish merely to indicate certain areas for study and directions of approach I cannot foresee the time when this will be possible and my personal feeling is that we suffer some loss in the variety of individual teaching in order to secure uniformity.

Again, in connection with the syllabus I have already tried to show that correlation with other subjects and integration of teaching method are cornerstones on which the successful working of the common syllabus rests. Without them the proportion of individual work cannot be increased and standards will not be raised. Although some progress has been made the position is not yet satisfactory. Difficulties include the amount of time and conference necessary to co-ordinate the departments and in particular to convey information of modifications in the work. In geography teaching where so much material is shared with other subjects this problem is very apparent.

Problems arise also from teaching methods. These depend very largely on practical and individual work indoors, around the school and in the field and the shortage of specialist rooms and equipment is proportionately more serious than in other types of school. At Great Barr there is only one, rather small, room set aside for geography although three ordinary classrooms which are available for only part of the day have some special equipment. I estimate that five rooms would be barely sufficient for the school when full but cannot imagine

that they will ever be available. The number of Local Education Authorities which are prepared to regard geography as a practical subject must be very small.

Finally one cannot escape the question of training teachers for comprehensive schools. In Great Barr there is a fairly high proportion of non-graduate and largely non-specialist teachers—probably higher than in most comprehensive schools because of the circumstances of the foundation. There arises the problem of finding subject specialists trained to deal with a wide variety of abilities up and down the school and often in the same class. I feel that the non-specialist must almost certainly disappear—it seems unthinkable that one teacher will cope with a variety of subjects as well as with such a variety of children. The comprehensive school makes big demands on both academic and teaching ability. To meet the first, a degree or a three-year college training is essential. Special pedagogic training, however, seems hardly to have been considered yet. Apparently neither the University Departments of Education nor the colleges are providing courses for would-be teachers in comprehensive schools though it is true that a new entrant to the profession could hardly receive more than an introduction to the special problems whilst undergoing training. Within the schools one must at first devote one's time to one or two age groups only, taking responsibility for other parts of the school in stages later.

At the same time I am not happy about the tendency to advertise some appointments for specialists in certain sections only of the schools. Vertical divisions of the work must inevitably involve streaming and lead to multilateralism. Horizontal divisions, restricting teachers to a small age range, tend to entail repetition of work and time-wasting re-orientations as the children pass from one division to the next. Allowing for personal interests in certain aspects of the subject, the specialist team must have a unity of purpose and an agreed means for carrying out that purpose. Syllabuses may indicate directions but such variety and agreement may be achieved in practice only by experience at all points of the school. I feel sure that in time this will prove to be an essential factor in the attempts which are being made to find a way to a common education in the comprehensive schools.

This Changing World

EDITED BY G. J. BUTLAND

DISTRIBUTION OF WELSH-BORN POPULATION IN ENGLAND, 1951

Between 1931 and 1951 Wales experienced a net loss by migration of 6·7 per cent of her population, and at the latter date nearly 650,000 people who had been born in Wales were enumerated in England. Their distribution is shown on the accompanying map, statistics for which are unfortunately given only for each county and urban area of over 50,000 population.

Fig. 1.—Distribution of Welsh-born persons 1951 (excluding towns of over 50,000 population.)

There are thus inevitable variations in the degree of detail available for different counties, so that in Map 1 the location of dots is necessarily arbitrary.

As a simple portrayal of the results of population movement out of Wales, the map is concerned solely with *where* the people settled, and not with *when* the moves actually occurred. The distribution which it portrays suggests that there are five elements in this migration from Wales to England.

In the first place, although the migration has been primarily urban in character, there is a not insignificant rural element, particularly in the Welsh border counties. In these counties the manner of publication of the statistics undoubtedly accentuates the rural character of the migration by

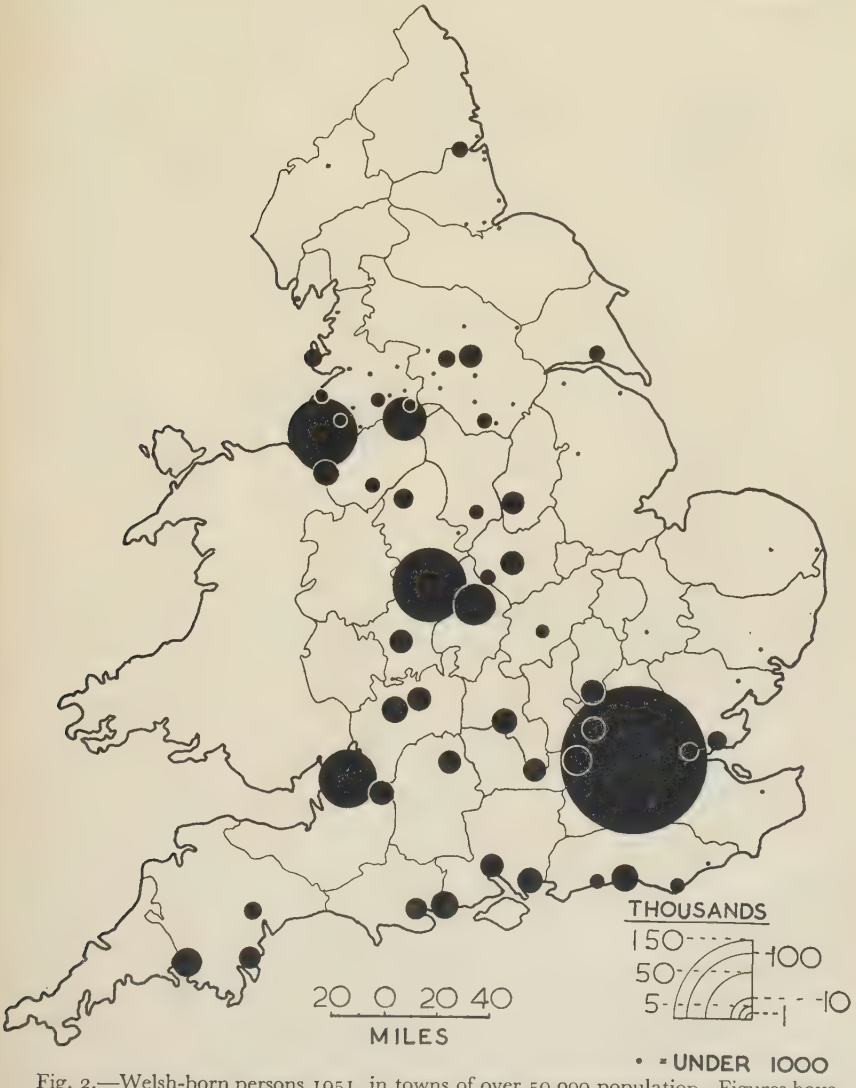


Fig. 2.—Welsh-born persons 1951, in towns of over 50,000 population. Figures have been grouped for the Manchester/Salford, Merseyside, West Midland and Greater London conurbations.

masking any concentrations which may occur in the market towns of under 50,000 population, but it is unlikely that these non-industrial towns will have absorbed all the Welsh-born people now resident in the respective counties. This type of movement may reflect not rural depopulation, but rather a rural migration to more prosperous farming regions. On the eastern slopes of the Welsh uplands, with valleys opening on to the plains of Cheshire, Shropshire and Hereford, there has always been a tendency for the successful farmer to move from the hill or marginal upland farm to one which is larger, more remunerative, and more low-lying. Since the numbers of lowland farms within Wales are limited by physical conditions, there has been an inevitable overspill into England. Those counties contiguous with Wales show significant concentrations, while an outer and less continuous crescent is formed by counties such as Wiltshire, Hampshire, Berkshire and non-industrial Lancashire. In so far as the farmers who have vacated the upland farms have not been replaced, this movement does, in fact, represent rural depopulation within Wales itself.

The second element is the migration of Welsh-born people to the older industrial centres of England, and this is revealed on the map by pockets of such people in the towns of Tyne-side and Tees-side, in the West Riding, in North Staffordshire, and in the textile areas of Lancashire. These industrial areas had affinities of occupational structure with the South Wales region, and they have experienced the same trade recessions. Their Welsh element therefore is not only relatively small in number, but is probably the result of migrations which pre-dated the inter-war depressions; there is, for example, evidence that Welsh steel workers were encouraged to migrate to Tees-side when that area's metallurgical industries were being developed. The mobility of labour involved in this earlier migration therefore involved a change of area but not a change of occupation, and was not caused by a search for employment.

The considerable numbers of Welsh-born people in many of the English ports reveal a third migration element. Mersey-side and Bristol have quite obviously been the main foci of attraction, the former having long had a reputation as a centre of Welsh infiltration, and it is evident that geographical contiguity and ease of access have contributed to this movement. These factors, however, cannot explain the appreciable Welsh populations of Plymouth, Southampton and Portsmouth, nor indeed those of the Humber and Thames ports. While depression in the Welsh ports themselves has been a primary cause of this migration, two other factors have also played their part. The first is the decline of Pembroke Dock as a naval station, and the second is the virtual extinction of coastwise trade in the small, non-industrial ports on the western seaboard. Younger members of sea-going families have been forced to leave these older centres in order to follow their traditional calling.

The fourth element in the pattern of migration is also coastal in distribution, and is the result of a movement from Wales to some of the English sea-side resorts. In Blackpool and Southport, in Torquay and in the south coast towns, this Welsh element is predominantly female, and this fact reflects the pre-1945 industrial structure of the Principality, when surplus female labour was forced to seek employment outside Wales in business or in domestic service. With the diversification of industry in South Wales,

and with the general decline of domestic service, this type of migration has vanished, but very recently, in some South Wales areas where light industry is suffering a recession, there are reports that increasing numbers of young women are making enquiries from Youth Employment Officers concerning this type of employment.

The last element is numerically the most important, and is that of migration to the newer centres of light industry in England. The resultant distribution pattern is naturally that of the 1921–45 development of light industry, with certain concentrations, particularly in the Greater London region. This conurbation has almost one quarter of the total Welsh-born population living in England, by far the greatest numbers having come from the South Wales coalfield, though some of the Welsh rural counties have contributed significant numbers, particularly to the commercial life of the metropolis. Both the County of London and the newer towns of the periphery have been affected, the outstanding example being Slough, where Welsh-born people accounted for 9 per cent of its 1951 population. North and west of London the new industrial functions of Luton, Bedford and Reading are clearly reflected on the map, as are the two other outstanding concentrations of Welsh people in the Midlands and in the Manchester–Salford conurbation.

These concentrations apart, however, the map reveals that people have tended to migrate from Wales to *any* area where there was work to be obtained, thus offering completely mobile labour by accepting new occupations and new homes. It should be added finally that not all this migration was industrial, for Wales has long had a tradition of exporting its professional classes as well as its industrial workers, but their distribution will naturally follow no set pattern.

University College of Wales, Aberystwyth. J. Gareth Thomas.

THE FRENCH OIL INDUSTRY

As in some other West European countries the consumption of oil in France has risen rapidly since the war. Crude oil imports are increasing as refinery capacity is augmented, and for this reason, imports of refined oil have decreased:

Oil Imports (in 1,000 Tons)

	Crude Oil	*Refined Oil*
1938	6,860	1,096
1947	4,890	1,527
1948	7,992	868
1952	12,000	442

With this change has come an interesting change of suppliers, brought about by the dollar shortage. Imports from the Americas have sharply declined, and those from the Middle East have shown a corresponding increase:

Source of Imports (in Percentages)

	U.S.A.	*South America*	*Middle East*
1938	34	23	43
1952	6	2	92

The refineries at the Atlantic ports have suffered no eclipse as a result of this change in supplier. Although the route from the Middle East to

Marseilles is shorter, the cost of transport of the crude oil by sea to Marseilles and then overland to the Atlantic coast is higher than sending it by sea around Iberia.

Imports of Crude Oil at Le Havre (in 1,000 Tons)

	1947	1953
U.S.A.	323	145
S. America	1,808	646
Persian Gulf	211	2,553
Syria and Lebanon	8	5,044

Another factor which dominates the French petroleum industry is that of foreign control. This applies to the companies which produce the oil, to its transportation, and distribution within France, and of course the areas from which the oil is derived. Of the oil which is imported from the Middle East, three-fifths of it comes from Kuwait and Saudi Arabia, and two-fifths from Iraq. These areas are controlled by predominantly British and American companies. The only French company in the area, *Total*, has 23·75 per cent of the shares of the company operating in Iraq, and 6 per cent of those of the International Consortium controlling the concessions in South Persia.

Half the French oil coming from these areas was transported before November 1956 through the Syrian pipelines to Banias and Tripoli, and half via the Suez Canal. Thirty-three per cent of all crude oil destined for France is carried in foreign vessels, a decrease compared with 1938 when it stood at 80 per cent. Of the vessels which are technically French (and are counted as such in the figures below), many belong to French subsidiaries of British or American concerns.

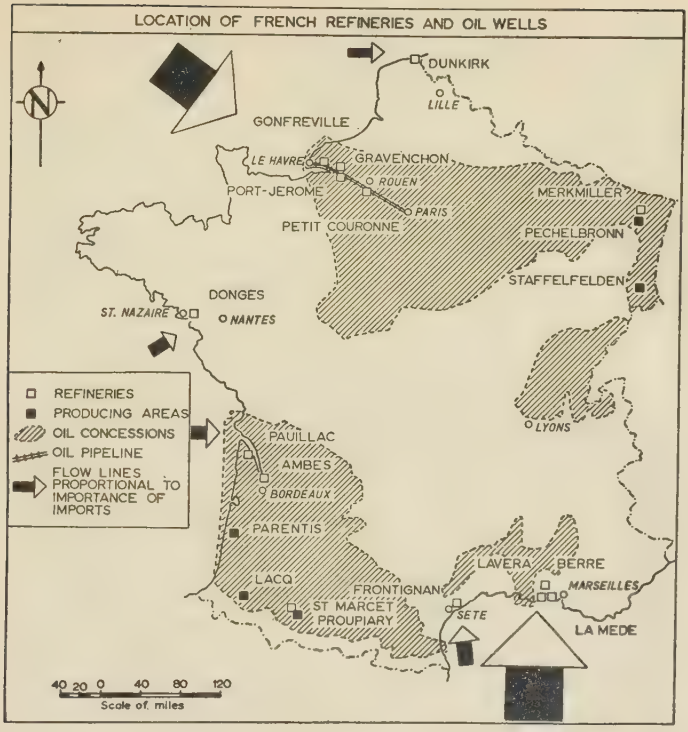
Crude Oil carried in French Tankers

	Tons	*Per Cent of Total*
1938	5,208,764	28·28
1956	24,100,000	65·45

There are thirteen refineries in France, five of which belong to British concerns and four to American. They are situated at Dunkirk, the mouth of the Seine, the lower Loire, the Gironde, near Sète, around Marseilles and two small ones in Alsace, at Merkmiller and Staffelfelden. By far the most important groups are those centred on Marseilles and those in the Basse-Seine region.

The mouth of the Seine was chosen as a suitable location for refineries in 1925 so that it would be relatively secure strategically and yet be near the greatest consumer, Paris, 228 kilometres away, to which the area is connected by river and by a pipeline constructed in 1953. The refineries in descending order of importance, Gonfreville, Port Jérome, Petit Couronne and Gravenchon, all receive crude oil from Le Havre, 81·7 per cent of this port's imports now consisting of crude oil for these refineries.

The refineries of Berre, La Mède and Lavéra, all near Marseilles, supply south-eastern France with its needs. Their capacity was only 200,000 tons less than those of the Basse-Seine region in 1953. The largest petro-chemical industry comprising four factories depending on the waste of the oil-refining process is also situated here.



	1953	
	Refinery Capacity	*Oil Treated*
	(in 1,000 tons)	
Basse-Seine	9,450	8,293
Marseilles	9,250	8,492
Dunkirk	2,000	1,764
Gironde	1,800	1,469
Donges	1,600	1,500
Frontignan	1,250	1,065
Alsace	80	55

France herself is not without oil. It is found near Pechelbronn and Staffelfelden in Alsace; also at Parentis, Lacq, St. Marcet and Proupiary in Basses-Pyrénées. Again foreign interests dominate the industry. The government granted a concession covering a wide area of the Landes to Standard Oil in 1956, after the discovery of oil at Parentis-en-Born on the Etang de Biscarrosse by that company in 1952. At the present time France produces one-twentieth of her own oil needs, most of it coming from this small field. Here the oil is of high quality and there are fifteen wells in production. A further two wells are dry and another six are being drilled. Reserves of oil in this region are ample and it is planned to build a small refinery near Parentis.

Lacq, in the same region, is more important as a natural gas centre, this fuel being piped to Bordeaux, Toulouse and Pau. The intention is, by 1961, to provide France from this source with one-third more than its present total consumption of gas. In development, priority will be given to south-western France, an area with relatively little industrial development hitherto.

Internal Production of Oil and Natural Gas

	Crude Oil (in 1,000 tons)	*Natural Gas* (in 1,000 cu. metres)
1948	51·8	174
1949	57	228

An important effect of the Suez crisis and its aftermath in France has been the added incentive it has given to increase oil production within France and in North Africa and to a more intensive search for oil-bearing deposits. Huge areas of the Paris Basin, Alsace, Burgundy, Aquitaine and the mouth of the Rhône are now being searched. On 11th March, 1957, it was reported from Parentis that natural gas had burst through to the surface near the town from a depth of 12,200 feet at great pressure. This probably means that the geological formation at Parentis is similar to that of Lacq, where the gas has so far proved more important than the petrol above it. A third deposit of good quality oil has recently been discovered between Lacq and Parentis. (Statistics from *Annales de Géographie*, 1953, 1955, 1956.)

University of Leicester D. Hallas.

LAND UTILIZATION IN CALABRIA

Amongst the regions in which the Italian agrarian reform laws of 1950 are being carried out Calabria has received the widest publicity though it accounts for little over 7 per cent of the total area of such regions and under 11 per cent of the total area expropriated. Calabria is the region with the lowest income per head, only 42 per cent of the Italian average in 1954, and it had been a focus of unrest before the establishment at the end of 1947 of the Organization for the Development of the Sila. The name of this granitic and schistose mountain mass is derived from the Latin *silva* and half its surface is still under forest. In 1950 the Organization was given responsibility for the agrarian reform not only on the Sila but on the hills and alluvial plains on the north, east and south of the mountain core. Basic cartographic data against which the geographer can assess the operations of land reclamation and agrarian reform in Calabria have been provided by the recent publication by the National Research Council of the first two sheets of the Land Utilization Map of Italy, with an accompanying memoir by Professor Ferdinando Milone.

The isolation of the uplands and the relative sparsity of their population have protected the forest in the past. Sweet chestnut grows on the steep slopes at 800–1,000 metres, Calabrian pine dominates much of the domed upland, reaching an altitude of 1,700 metres, and beech grows above 1,300 metres. Fire is a serious enemy (there were around a hundred forest fires in 1954) and it has been caused by the smoking out of brigands, vendettas and the antagonism of grazing interests. Sheep and goats and erosion by the violent seasonal rains, felling for timber and charcoal and clearing for cultivation (a process that may be further stimulated by the agrarian reform) have all been potent agents of destruction. Where the forest has been destroyed pasture has frequently replaced it as a secondary formation. Most of the pasture, however, occupying about a quarter of the upland, is on the broad almost level areas, either where pines have been cut or where

long fallows are being carried out. There is some pasture also on rough areas in the transition zone between chestnut and pine, where the soil is very thin. Much of the pasture land is very poor but on the schistose soils it can be improved and the introduction of better animals can raise productivity. Large landowners, some of whom had over 15,000 hectares of scattered property, maintained livestock on their upland estates in summer but on the plains in winter. Prior to the reform there were on the Sila upland only 30,000 hectares under cultivation, mainly by large tenants, using a rotation of rye and pasture or, on better lands, potatoes, rye or wheat, and two years of fallow. A quarter of the area in private hands belonged to owners with over 500 hectares each. On the other hand the great majority of holders of land had less than 2 hectares each.

The total area for which the Sila organization is responsible is 574,000 hectares, of which 170,000 are on the Sila upland, 362,000 on the neighbouring hill and alluvial lands and 42,000 in the Caulonia enclave to the southwest. The expropriated area amounts to only 76,000 hectares, from which just over 19,000 families have received 4 hectares each. The peasant pays over a period of thirty years a price not exceeding two-thirds of the cost of development and compensation. The principal area on which the Sila organization has carried out reclamation and reform lies behind the small port of Crotone, on the deeply eroded clay belt of the hills between the granite of the Sila and the sandy fringe of the Ionian Sea, its core being the region known as the Marchesato. This was already the largest continuous stretch of sown crops in the area covered by the Calabrian sheets of the Land Utilization Map and its agriculture consisted of extensive low-yielding wheat alternating with fallow. It is not surprising that the total production of wheat in Calabria in 1951–54 averaged only 90 kilograms per head, insufficient to meet local requirements. It is on this "sea of Pliocene clays" that the agrarian reform has been involved in one of its most massive, highly mechanized and costly operations in hydraulic systematization, preparation of the soil, building of roads and houses and procuring of drinking water. The attempt is being made to make this tortured landscape, eroded by torrential rains in autumn and winter, hot and drought-stricken in summer, fit for small family settlement based on cereals, beans and alfalfa. Next in area to these Ionian hill lands are the riverine alluvial lands such as those of the Crati on the north, where Sybaris once flourished.

Professor Milone reckons that about one million people emigrated from Calabria in the period 1875–1925 and that but for this the present population of 2 million would have reached 4 million. It was probably mainly the remittances of emigrants that enabled agricultural improvements to be carried out in the past. The planting of tree-crops was a most valuable investment, and the girdle of tree-crops is especially broad on the southwest and north of the Sila and north of the more southerly mountain mass, the Aspromonte. Citrus proved to be the most valuable of all and is found up to 300 metres. The maps show intensive citrus cultivation in the west, mainly on the riviera of Reggio Calabria and on the recently reclaimed plain of the lower Mesima. Specialized orange plantations take the lead but there are also large plantations of mandarines, lemons and bergamot, both specialized and in association with field crops. Together these place Calabria second only to Sicily in citrus production. Next to citrus in value

are the olives, grown at altitudes up to 600 metres and especially important in Southern Calabria. Below them in altitude and also in value of production are the vines.

The following table shows for the whole of Calabria the percentages of agro-forestal area and value of production in recent years.

	Area (1955)	*Production* (1951–54)
Agro-pastoral (excluding tree crops)	57	48
Tree crops (citrus, olives, vines, etc.)	17	42
Forest	26	10

In a region where capital and good land are scarce but labour is abundant the importance of fruit trees and vines, provided markets are good, is apparent. The establishment of small family holdings in areas where great physical difficulties have to be overcome and especially in those sections where irrigation may not be available raises a number of serious problems that even the hard work of the Italian peasant cannot overcome. The experiment is not only costly but courageous. What we do know for certain is that agrarian reform, even with the technical assistance of the agencies charged with carrying it out, cannot cope with the overpopulation of the South.

Carta della Utilizzazione del Suolo d'Italia. Sheets 19 and 20. Published for the Consiglio Nazionale delle Ricerche by the Touring Club Italiano, Milano, 1956.

Ferdinando Milone. *Memoria illustrativa della Carta della Utilizzazione del Suolo della Calabria.* Napoli, Centro di Studi per la Geografia Economica, 1956.

University of Edinburgh. C. J. ROBERTSON.

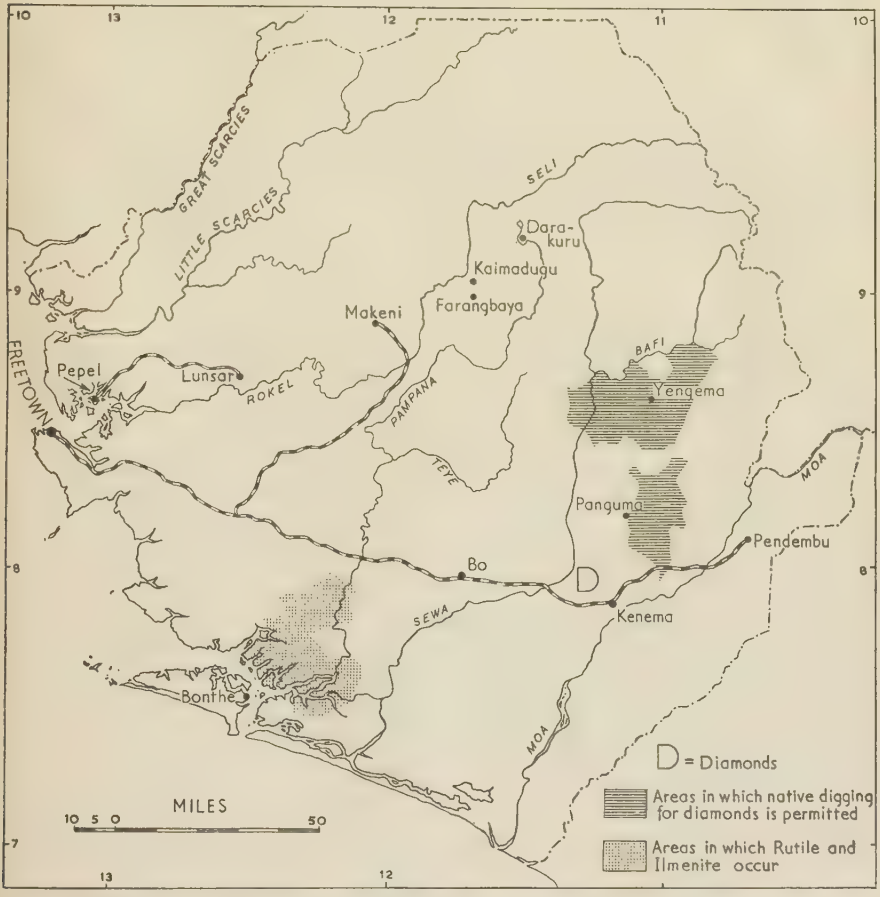
MINERAL DEVELOPMENTS IN SIERRA LEONE

Ever since 1926, when large reserves of iron ore were discovered at Lunsar in the Marampa Chiefdom, the importance of mineral production in Sierra Leone has been increasing. The first mineral export was 24,550 tons of iron ore in 1933, and today almost half of the total exports by value are accounted for by minerals. These include diamonds and chromite, in addition to iron ore, but gold is no longer of much importance. Three aspects of actual and potential development are worthy of notice.

The first refers to alluvial diamond deposits, which were first discovered in 1930. Five years later the Sierra Leone Selection Trust acquired the exclusive right to prospect for, to mine and to market Sierra Leone diamonds, except in the iron ore concessions. For the last 20 years the principal area of working has been in the basin of the Bafi, with the mining headquarters at Yengema, but further useful deposits are known to exist at Panguma.

During the past four years, however, a radical change has come about, as diamonds have been discovered in significant quantities over wide areas, especially in the alluvial gravels of the Sewa and Moa rivers. People have flocked in from the areas around, and thousands of outsiders, especially Mandinkas, have hurried in from French territory. Illicit mining has reached astonishing proportions, and one estimate of the value of stones smuggled over the border given in Amsterdam was £18,000,000 per annum! The effects of this activity are several. Farms lie neglected and the illicit diggers herd together in their *shimbecks* or squalid hovels constructed of palm fronds, with no sanitary conveniences whatsoever. Disease naturally

flourishes under such conditions, and one virulent type resembling a cross between poliomyelitis and cerebrospinal meningitis in its effects is causing serious concern. Lack of respect for tribal sanctions or for any form of law and order has increased sharply, and fights between the police and illicit miners have been not infrequent. The Government is, of course, deeply concerned as it has been losing revenue from unpaid export duty on the smuggled stones. Economic repercussions are likewise serious, for inflation runs riot thanks to the diamond money; a bowl of rice may cost 4/–, a small chicken £1, and a gallon of petrol up to 16/–.



Attempts have now been made to restore order in this situation, and an agreement has been signed between the Government and the Selection Trust by which the latter have renounced their rights over all but 150 square miles, mostly in the Yengema area, in return for monetary compensation. Licences are now issued to a limited number of Africans, permitting them to undertake digging on their own account, while official purchasing offices have been established in Bo and Kenema. At least one diamond has been bought over the counter for as much as £2,000. The strangers who have flocked over the border from French territory have also been ordered

to return home, and it is reported that some 25,000 have left Konon District alone. It is early yet to see whether these measures will bring order into this chaotic situation, but there are encouraging signs.

The second line of development is likely to be in Tonkolili District, where large reserves of iron ore await development in the Sula-Kangari Mountains, between Darakuru and Farangbaya. The main body of ore consists of haematite carrying 50–65 per cent iron, which grades downwards into a quartz-magnetite schist of 35–45 per cent iron. The principal problem is that of transport, and it is proposed to extend the existing railway, a private one owned by the Sierra Leone Development Company, for 73 miles from Lunsar to Kaimadugu. This is not an easy undertaking, partly because of the uneven nature of the ground where the Sula-Kangari Mountains have been deeply dissected by the Pampana, Seli and other streams, and partly because of sub-surface rotting. In the tropics such rotting may penetrate downwards as deeply as 100 feet, so that surface rocks are not always stable and coherent. Widespread bush clearance for farming may initiate landslides as it has done elsewhere in Sierra Leone and side-slipping of the duricrust is particularly likely to happen at the passage of a well-laden freight train. Problems are still being investigated, but it is estimated that, if these difficulties can be overcome, production should in due course be of the order of 3,600,000 tons per year.

The third development project is in relation to the sands of the southwest coast near Bonthe. These in common with other West African sands carry deposits of titanium. This occurs in the form of ilmenite, similar to that of the Gambia, and rutile, but composition is variable, and mixtures are not uncommon. These titaniferous sands are clearly derived from primary sources such as have been located in the Teye valley. Preliminary work has shown that widespread deposits occur in creeks extending over nearly 200 square miles near Bonthe, not at present a deep-water port. The rutile is unfortunately low-grade, and experiments are proceeding to discover whether extraction is commercially feasible. One advantage is that the deposits lie near tidal water, though port equipment would have to be installed and roads driven through difficult swamp and bush country. This source may be one of the largest in the world, with a possible output of 100,000 tons of ore per year by dredging methods.

University College, Ibadan. H. R. Jarrett.

The Geographical Association

APPOINTMENTS

Professor R. F. Peel, head of the Department of Geography at the University of Leeds, was appointed in September 1957 to the Chair of Geography of the University of Bristol, in succession to Professor W. W. Jervis who retired recently.

NOMINATION OF NEW MEMBERS OF COUNCIL

Four new members of Council are due to be elected at the Annual General Meeting to be held on 2nd January 1958, to replace retiring members. Members nominated must have expressed their willingness to serve on Council from 1958 to 1960; nominations require to be signed by four other members of the Association.

ANNUAL CONFERENCE 1958

The Annual Conference will be held at the London School of Economics from 31st December 1957 to 3rd January 1958. The programme has already been circulated to members. Further copies may be obtained from headquarters office or at the Conference.

SPRING CONFERENCE

The Spring Conference, which will include a study of the geography of Central Wales, will be held at Aberystwyth from 8th to 12th April 1958, under the direction of Professor E. G. Bowen. The programme and registration form will be circulated to members in January and applications for accommodation, excursion bookings etc. should thereafter be made with as little delay as possible. Accommodation will be reserved in a University Hall of Residence (single rooms). This year's meeting will commemorate the fortieth anniversary of the moving of the Association's headquarters to Aberystwyth in 1918, under the honorary secretaryship of Professor H. J. Fleure. It is hoped that a large number of members will attend the meetings and the functions which will be held.

SUMMER SCHOOL 1957

Under the leadership of Professor A. E. Smailes, who was assisted by Dr. A. Garnett, Dr. J. Houston and Mr. J. L. H. Sibbons, a party of 72 geographers travelled to Aix en Provence which provided a delightful centre for the second time for the study in the field of part of Mediterranean France. The scheme of work was similar to that of the first course held there in 1955; some longer excursions widened the field of survey. In all, some 1,500 miles were covered in the field, giving members a vivid impression of local and regional differences and of the changing personality of this fascinating landscape.

The leaders are to be thanked warmly for so stimulating a course, and we are indebted to the Directors of experimental and research establishments and proprietors of estates who contributed much valuable first-hand information regarding land use in the region. We express thanks also to the Recteur of the University of Aix and to the Directeur of the Cité Universitaire for the hospitality extended to us in our use of the accommodation there.

SUMMER SCHOOLS 1958

Two courses are planned for the summer vacation in 1958. Preliminary notices and registration forms have already been circulated to all members. The number of places on each course will be strictly limited and early application for reservations is strongly recommended.

A course of fieldwork in Scotland will be directed at "The Burn," a very comfortably equipped field centre near Edzell, Angus, by Professor J. W. Watson, University of Edinburgh, and Professor D. L. Linton, University of Sheffield. To be held from 26th July to 6th August 1958, the course will include field excursions in Strathmore, south Aberdeenshire and the Grampian Mountains. The inclusive fee will be about £23.

A summer school on the Continent will take the form of a course on the Geography of the Middle Rhineland, under the leadership of Mr. T. H. Elkins, M.A., and Mr. E. M. Yates, M.A., lecturers at King's College University of London, both of whom have much experience of leading parties in this part of Germany. The course will be held from 14th to 28th August 1958 and will use two centres consecutively—Kettwig in Ruhr and Mayen in Eifel. The fee of about £40 will include air travel, by which it is proposed that the school will make the journey as a party to and from Germany.

INTERNATIONAL GEOGRAPHICAL WEEK AT BRUSSELS

The Belgian Federation of Geography Teachers proposes to arrange an International Geographical Week during the Brussels World Fair, from 4th to 11th August 1958, as an interim meeting of the International Union of Associations of Geography Teachers. Fuller details of this meeting and registration forms have already been circulated to all members in the Summer Schools 1958 leaflet. The Belgian Federation asks that we should advise their secretary as soon as possible of the numbers of British members who wish to attend. Members resident in Britain wishing to participate are urged to return the completed registration form to headquarters office without delay; oversea members should write by air letter to Mlle. M. de Vreese, 8 Onafhankelijkheidslaan, Ghent, Belgium.

BRANCH NEWS

Efforts to establish a new branch in the Southwest deserve the support of members in the Plymouth district. The secretary of the new branch, Mr. A. J. Lunnon, Devonport High School for Boys, Stoke, Plymouth, will be glad to hear from local members and to supply details of the programme.

NAIROBI GEOGRAPHICAL ASSOCIATION

A Geographical Association has been founded in Nairobi whose objects are generally similar to those of a local branch of the Geographical Association of Great Britain. Monthly meetings—lectures or excursions—are held and while there is as yet no publication, a circular letter is sent to members. The Association will be pleased to welcome geographers visiting East Africa and the Honorary Secretary would be glad to hear in advance from visitors, with expected date of arrival and length of stay and aspects of geography in which they are interested. The Honorary Secretary is Mr. W. T. W. Morgan, P.O. Box 11375, Nairobi, who would supply on request information about subscriptions.

GIFTS AND COVENANTED DONATIONS FROM MEMBERS

We acknowledge very gratefully donations from the following members in the period October 1956 to October 1957:

J. L. R. Aldis
W. W. Anson
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* indicates covenanted donations.

FIELD WORK CENTRES FOR SCHOOLS

There has been a very poor response to the suggestion, announced in the January issue of *Geography*, that a record should be compiled at headquarters office of field centres suitable for school parties. It is hoped that many members with experience of school field work will be willing to contribute to such a compilation, which could be consulted by other members and which is nowhere else available in the detail usually required by teachers planning school journeys or study courses. The information required includes the address and location of field centres, hostels, guest houses etc., with details of accommodation, availability of transport, accessibility to good field teaching areas; forms for supplying these details will be sent on application to headquarters office.

FIELD STUDIES COUNCIL BURSARIES

The Fields Studies Council has announced that a number of bursaries of about 2½ guineas for a week's course (and *pro rata*) can be offered through the generosity of the Carnegie United Kingdom Trust, to facilitate the attendance of members of local scientific societies at courses organized by the Council. Particulars can be obtained from the Wardens of the respective field centres when application for a booking on a course is made. Information about the courses organized by the Field Studies Council can be obtained from the publicity secretary, Mrs. F. H. C. Butler, Ravensmead, Keston, Kent.

FREDERICK SODDY TRUST

Under the will of Emeritus Professor Frederick Soddy, Lee's Professor of Chemistry at Oxford from 1919 to 1936, funds have been provided for the support of regional and local studies. The intention of the Trust is to aid, in particular, members of the teaching profession and students of the sociological sciences, especially at the outset of their careers and in connection with group studies. Inquiries for fuller information about the Trust should be addressed to Mr. P. J. Bunker, 9 The Drive, Hove 3, Sussex.

INFORMATION ON PETROLEUM

Recent pamphlets published by the Petroleum Information Board, 29 New Bond Street, London W.1, are " Oil in the U.S.S.R." and statistics of world oil refinery capacity and world production of petroleum. These and other leaflets will be supplied free of charge on application to the P.I.B.

LANTERN SLIDES

It would be of assistance in an inquiry about visual equipment being made at headquarters office if teaching members and others who regularly make use of slides would send, on a postcard to headquarters, information about the *sizes* of slides which they use or borrow and the sizes of *projectors and slide carriers* which they find to be most commonly available to them, whether in schools or for lectures elsewhere. A prompt response to this request would be of the greatest value.

FOREIGN EDUCATIONAL FILMS

The distribution and hiring of English versions of educational films from the U.S.S.R., China and Eastern Europe are carried out by Plato Films Ltd., 18 Greek

Street, London W.1, who will supply catalogues and details of special hire charges for schools and educational institutions.

INTERNATIONAL GEOPHYSICAL YEAR 1957–8

In a small booklet published by Methuen and Co. at 2s. 6d., *Guide to I.G.Y.*, members of the British National Committee of I.G.Y. describe in simple language the research work in various sciences which will be carried out in 1957–8. A final chapter makes suggestions for simple observational work, much of which could be undertaken in schools.

The Royal Society has published *The United Kingdom Contribution to the International Geophysical Year* 1957–58 (10s.), the official description of the U.K. programme and an amplified text, prepared by experts, of 72 pages and 5 maps. It can be ordered through booksellers.

THIRD INTERNATIONAL CONFERENCE OF TEACHERS OF GEOGRAPHY

The Third Conference of the International Union of Associations of Geography Teachers was held from 25th to 31st August 1957 at Grenoble, France, organized by La Société Française des Professeurs d'Histoire et de Géographie. The programme and meetings were arranged by the Institut de Géographie Alpine under the direction of M. and Mme. Veyret. Over 350 persons attended the Conference, representing 22 countries, including, for the first time at these meetings, Canada, Czechoslovakia, Greece, Poland, Spain, Turkey, U.S.A., U.S.S.R. and Uruguay. Most of the participants resided at the Lycée des Jeunes Filles, a modern girls' boarding school, where many of the meetings and an extensive exhibition were held.

After an address of welcome by M. Bruley, President of the French Association, the first lecture took the form of an exposition by M. Paul Veyret of the geography of Grenoble and its environs, giving an illustrated and most logically presented picture of the setting in which the Conference would be working, a setting which, being Alpine, could be demonstrated in the field by an ascent by téléferique of the rock of the Bastille overlooking the town. Lectures given later during the Conference were on subjects both geographical and pedagogical: the Indian sub-Continent (Dr. A. Geddes, Edinburgh); development of the French Sahara (M. Capot Rey, Algiers); agricultural regions in Denmark (Dr. A. Kampp, Copenhagen); the idea of the region in geography teaching (M. Chabot, France); geography teaching and research (Dr. W. Jong, Netherlands); geography teaching in Poland (Mme. Czekanska), in the U.S.S.R. (Mr. A. Darinsky) and in France (M. François).

A series of visits to factories, works and hydro-electric plants illustrated the highly industrialized character of Grenoble and the reason for its rapid growth and extensive building programme on the outskirts of the town. Longer field excursions enabled visitors to see the place of Grenoble and the river Isère in the wider setting of Alpine and Rhône valley geography. A day's outing, made by all members of the Conference, traversed the massif of the Vercors, a deeply dissected upland of highly folded cretaceous limestone of the pre-Alps, to the Rhône valley, to reach, via Montelimar, the Donzère–Mondragon section of the Rhône barrage scheme, where the André Blondel hydro-electric plant at Bollène was inspected.

The Conference closed with a choice of 2 two-day excursions, respectively under the expert guidance of M. and Mme. Veyret. Two mass-migrations of geographers departed very early on the first morning for Chamonix and Val d'Isère, each following a circuitous route through the upper valleys of Rhône tributaries and across high cols. On the Val d'Isère excursion the main features examined were the effects of recent floods on the rivers Romanche and Arc, the intensive hydro-electric development of the upper Isère system, including the Tignes dam, and the development of tourism in the winter sports centres. The return journey followed the Tarentaise

and the Grésivaudan troughs. The outward route on the Chamonix excursion led via Chambéry, Annecy and Bonneville to the Chamonix basin. Here, early on the second morning, the party, almost two hundred strong, ascended the téléferique of the Aiguille du Midi, where clear weather and the early morning sun revealed the beauty of the Mont Blanc massif and its glaciers. The return route was via Albertville and Grésivaudan.

The International Union appreciated the warm welcome and the receptions given to its members by many public bodies. It was very grateful for the excellent administrative and organizational service put at its disposal by M. and Mme. Veyret and the staff of the Institut de Géographie Alpine. These Alpine geographers are to be congratulated most warmly both on the conference arrangements and on the lessons in Alpine geography which they gave, mostly in French of the greatest clarity, but generously translated into English and German.

An innovation of this Conference was the production of a "livret-guide" (in English and French versions) providing précis of several of the lectures, and a well-illustrated guide to the excursions. A copy of this booklet is now placed in the Association's library and it is recommended for consultation by members proposing to visit the pre-Alps near Grenoble. It provides an introduction on Alpine structure, and a physical, historical and economic summary survey of the ground covered by the excursions described above (essentially the upper valleys of the Isère, Romanche, Arc and Arve; centres such as Chambéry, Annecy, Chamonix, Albertville, Modane and Grenoble; the cols d'Iseran, du Lautaret and du Galibier). M. O.

Reviews of Books

With very rare exceptions, books reviewed in this journal may be borrowed from the Library by full members or student library members of the Association.

The Draining of the Fens. H. C. Darby. 2nd edition. 13·5 × 21·5 cm. xix + 314 pp. London: Cambridge University Press. 1956. 35s.

The second edition of Professor Darby's excellent book differs little from the first which was published in 1939. The author has, however, taken the opportunity to make a few minor corrections and to revise some statements. The last chapter has been enlarged to include the major disasters and improvements since 1939 and includes two new maps—Flooding in the Fenland March 1947, and Sir Murdoch MacDonald's 1949 scheme for further improvements.

Professor Darby has written a most fascinating book based on a sound foundation of documentary evidence. He describes clearly the physical, agricultural, administrative and social problems, and gives a very full account of the various efforts made to solve them, starting from the early attempts in the sixteenth century and taking his readers through all the phases up to the present time.

The work is well illustrated by excellent photographs and the maps and diagrams are clear, full of really sound information. The list of sources and bibliography at the end of the book is outstanding. As this is undoubtedly a standard work on the subject it should be in every grammar school library and of course in the library of all colleges and universities. J. E. G. M.

The Soviet Far East. A survey of its physical and economic geography. Erich Thiel. 13·5 × 22 cm. 388 pp. London: Methuen and Co. Ltd. 1957. 35s.

The Soviet Far East is concerned with territories of the U.S.S.R. which lie east of Lake Baikal and along the Pacific coast, from beyond the Bering Strait to Vladivostok. These lands nearly all drain towards the Pacific and the Amur is the principal river.

The title of this book, now that China, North Korea, North Vietnam and Outer Mongolia are all Communist states, is misleadingly broad and it would be more accurately rendered as "The U.S.S.R.'s Far East" or as "The Soviet–Russian Far East."

As Professor Thiel defines this vast region, its area of 1·5 million square miles (18 per cent of the total of the U.S.S.R.) supports only 7 million people (3·5 per cent of the total population of the U.S.S.R.). Most of these lands were loosely attached to Russia by the mid-seventeenth century; the most valuable part, potentially for food production, was firmly held by Manchu China and not secured by Russia until 1860. Interior mountainous areas in northeast Siberia, although visited early, were not well explored until this century. As a whole the U.S.S.R.'s Far East has still only modest economic value to the Union. Its wealth derives from its minerals (coal, oil, gold, platinum, tin, lead, zinc and mica), from its forests (coniferous and mixed hardwood), from its rich fisheries and from pastoral farming: of all these, tin, gold and fish make the most important contributions. In this century the region has had greater strategical than economic value to Russia and the U.S.S.R. in turn. The Trans-Siberian railway has not become, as was originally expected, Europe's open highway to China and the secrecy with which Russian developments in the Far East are shrouded has made Professor Thiel's task harder but none the less worthwhile. Although he exaggerates when he suggests (p. 5) that the political centre of gravity of the U.S.S.R. has shifted to its Far Eastern territories, it is evident enough that, given the Sino–Russian alliance, international interest will continue to focus steadily on this theatre.

Part I of *The Soviet Far East* discusses at some length the physical background, the population, the economy and communications. The historical aspect is not neglected and maps and diagrams assist the reader. Part II examines separately nineteen physical components of the U.S.S.R.'s Far East. While the book, as one would expect, is not so up-to-date as could be desired, it provides a substantial introduction to the regional geography of a pioneer-fringe region which is undergoing vigorous planned development. W. G. E.

A Geography of West Africa. H. R. Jarrett. 12 × 18·5 cm. x + 148 pp. London: J. M. Dent and Sons Ltd. 1956. 7s. 6d.

Man's Environment, Part II. Africa: a pictorial geography. J. M. Nicholson and J. G. Morton. 14 × 23 cm. xi + 280 pp. London: G. Philip and Son Ltd. 1956. 13s. 6d.

Dr. Jarrett's book is the first authoritative textbook for West African schools at Ordinary Level. Its success depends on simple presentation, precise maps and unpretentious format at an acceptable price. The first five chapters are a sound introduction to West Africa followed by six detailed chapters on the British territories and a final one on their modern problems. For English pupils at Advanced level, this becomes the only serviceable first reading and whilst its aim is obviously lower than the syntheses of Richard-Molard and Pouquet it is as yet the only English account of similar size which is able to approach them as complement or competitor. It has slight errors but these are mere details.

The most valuable part for English readers of *Africa* by Nicholson and Morton is in its last three-fifths, a systematic account of the Union of South Africa which will "satisfy the hunger of examiners for facts." It is solid homework fare at Advanced level and lacks only a summary of South Africa's fascinating pedology to strengthen an excellent section on soil erosion and irrigation. The first part of the book concerns the rest of Africa, increasing in detail with progress southwards. More and better maps would increase the value of the book—not those of atlas style, for the book is designed for use in conjunction with an atlas, but medium-scale maps, carefully redrawn, with commentaries, as samples of such areas as the Constantia valley, the

Veldts, Capetown and the Springbok flats. Many British schools (and schools in other countries too) find it difficult to acquire original South African map sheets and textbook illustration of this kind would help teachers to combine map work and regional study, a work method of which the authors, geography teachers both, would seem to approve. The book's most serious drawback is in the very poor reproduction of many of the photographs—a false economy in the production of a self-professed "pictorial geography" and a disfigurement of a volume welcome for its detail and ambitious purpose. The value of the carefully interrogative captions of pictures chosen "to bear considerable study" is in many cases greatly reduced by this weakness in production. The book could be used as an Ordinary level source or Advanced level revision notes.

R. W. C.

Shifting Cultivation in Africa. The Zande System of Agriculture. Pierre de Schlippe. 13·5 × 22 cm. xxxi + 304 pp. + 48 pp. plates and folded maps. London: Routledge and Kegan Paul. 1957. 42s.

The Zande live where the French and Belgian Congos adjoin the Sudan. They are shifting cultivators in the sense that they move their dwellings every ten or twenty years, as nearby land becomes exhausted. A single plot is normally cultivated for no more than 5 years in succession. Various misfortunes, such as the death of a wife, can also induce them to move, but they regard themselves as "settled." The shifting is not a system; each removal is the response of an individual family to a particular crisis.

When European administrations intervene in African agriculture of this kind, the results are often deleterious or impermanent; for which the blame is put on the malevolence of the climate or the conservatism of the native, and too rarely on lack of understanding on the part of the European. When Pierre de Schlippe began his socio-agricultural survey of the Zande in the Sudan in 1948 he already had much practical experience of African farming. He realized the need to study the culture and the environment together. "Unless this is done," he says, "it cannot be decided whether a limitation is environmental, traditional or both at the same time, and ways and means of overcoming them will not be found." This re-inforces the work of Trapnell and Clothier in Northern Rhodesia 20 years ago and of many geographers who have worked in the tropics.

The ways in which land use is related in details to the soils, and the soils to topography, are particularly satisfactory. Much information has been derived from mapping field and cropping patterns of small areas over several years. This book deals with a section of only one tribe, but partly for that very reason it is more revealing than a ponderous compilation on shifting cultivation might be. Its acute comments apply to much of central Africa. M. de Schlippe is now with FAO and a second book which he promises, dealing with the practical problems in the advancement of backward peoples, should with this volume be of great value to the academic student and to people working amongst Africans. A. T. G.

Spotlight on Canada Series. G. W. Brown (editor). Canada and the Commonwealth, x + 462 pp. Canada and the Americans, x + 486 pp. Canada and the World, x + 469 pp. 15 × 21·5 cm. London: J. M. Dent and Sons Ltd. 1954. 17s. 6d. each.

These three texts, designed for use in Canadian schools by pupils up to and beyond Grade ten—i.e. the age of sixteen—fuse together borrowings from history, geography and civics into a progressive course of "social studies". The first volume in this series deals with the historical evolution of Britain and its expansion overseas, together with brief sketches of the constituent Commonwealth countries. The next book focuses attention upon the American lands from the time of Columbus to the

present day, whilst the third volume attempts a world survey of the historical and geographical background to modern problems, both national and international.

Each book, handsomely produced and stoutly bound, is liberally endowed with line drawings, time-charts, photographs, sketch-maps, and illustrations of the travels through time and space of a likeable character who personifies the spirit of Canada. The chart and diagrams effectively supplement and summarize the text, while the sayings and doings of the ubiquitous Johnny Beaver are cleverly conceived; many pupils will be induced to dip into the text in order to elucidate some of his cryptic comments! The maps are the least adequate of all the illustrations; many are over-simplified and too compressed to satisfy a geography teacher. This is particularly true of the chapter in the first volume entitled " Spotlight on Britain" in which a map styled "Landform Regions" on p. 31 contains more than one error of location, whilst population density on p. 47 is a meaningless peppering of dots over a map. Another example of a geographical *reductio ad absurdum* occurs on p. 351 of the same book, where an unidentified temperature graph implies that summer and winter conditions are uniform over the whole of Australia.

The editors of this series are professors of history at Toronto, and their attempt to construct a synthesis of history and geography is heavily weighted in favour of the former. The fundamentals of world geography are accorded but one chapter—in the third volume—and the regional descriptions throughout are thin by English standards. It is difficult to see how these books could be adopted as texts in English secondary schools, even in those institutions where an emasculated geography appears timidly in a programme labelled "social studies", for they are expensive productions and the treatment of material is decidedly transatlantic. If copies were available in the library of a secondary school it is likely that they would be inspected with amusement, interest and profit by pupils of varied ages and abilities. But a truly geographical approach would have to be acquired from some other source.

L. J. J.

Sources of Australian History. The World's Classics Series. Selected and edited by M. Clark. 10 × 15·5 cm. xii + 622 pp. London: Oxford University Press. 1957. 9s. 6d.

Despite the implications of its title this book is intended more for the general reader than for the specialist student of history, and Professor Clark has compiled a useful anthology of extracts to illustrate social and political developments in Australia down to 1919. He has not confined himself to official Reports or Parliamentary Debates, but has drawn widely upon contemporary newspapers, travellers' tales, and bush-ballads. The resultant conglomerate is a golden treasury of verse and prose in which the reader may fossick at random, confident of striking it rich. The contents are divided chronologically into six sections, each with a succinct introduction to the period, together with useful suggestions for further reading. There is a detailed index, in which one error has been detected; the Darling Range of Western Australia has been entered under the Darling Downs of Queensland.

An interesting account of incipient soil erosion in the Grampians of Western Victoria is given by a pioneer settler during the eighteen-forties, but descriptions of landscape are rare; it is the changing social environment which receives more attention. Thus we may contrast the joy with which white residents in Sydney welcomed the convict-ship *Lady Juliana* in 1790 with their vociferous opposition to the arrival at Port Jackson of a similar vessel, the *Hashemy*, in 1849. There are several references to the aborigines in the earlier sections, beginning with Dampier's description of them in 1688 as "the miserablest people in the world," but two centuries (and over 400 pages) later on, when another Englishman, Francis Adams, makes a critical appraisal of "the Australian," he is now referring to the white man of Anglo-Saxon origin, and the blackfellow by this time has dropped out of the reckoning. These are

but two examples which illustrate the sequent occupance of Australia from the viewpoint of social history.

This compact volume is a handy travelling companion on 'bus or train. It makes an admirable bedside book—provided the reader has a strong lamp, for the print is small—and it is a worthy addition to the series of "The World's Classics."

L. J. J.

Elements of Geography, Physical and Cultural. V. C. Finch, G. T. Trewartha, A. H. Robinson and E. H. Hammond. 4th edition. 18 × 25·5 cm. x + 693 pp. London: McGraw-Hill Book Co. 1957. 56s. 6d.

The fourth edition of this remarkable American college textbook can fill a niche in English geography teaching better than other college texts. It could be used to conclude an advanced course in grammar schools or as a preparatory conspectus of the subject in the university first year. Unlike many such books it deals with fundamentals and is not a mere summary of geography. The world is its subject without too local a reference to the U.S.A. It is completely up-to-date and draws strength from its new co-authors. It contains much material that cannot be found in one volume in this country. The climatic section, as one might expect, is the best in the book, detailed, with excellent diagrams and statistics, up-to-date but not chasing will-o'-the-wisp theories. It uses, for instance, maps from the *Great Soviet World Atlas*, Vol. 1. In relation to earlier editions the climate system, which leans heavily on Köppen's scheme, and the system of vegetation types (particularly in relation to grasslands) are simplified. The soil section is first-rate, and the section on water resources brings a neglected topic into the forefront. The chapters on world resources and the cultural elements of geography seem rather too short and stereotyped to give a good balance. An appendix on the basis of American Land Survey and a selected list of maps of the U.S.A. (Topographic Quadrangles) of value for teaching purposes are of special interest. The excellently printed world maps in colour at the end of the book and the end-papers on climate, vegetation, soils, land forms and population are valuable and clear. For such a sumptuous publication the price is low.

D. J. D.

The Ways of The Sea. R. Pilkington. 12·5 × 19 cm. 166 pp. London: Routledge and Kegan Paul Ltd. 1957. 12s. 6d.

This little book is about the sea, mainly the physical aspects and properties of ocean water, dealing in turn with waves, tides, currents and the changing coastline; and answering questions like what causes waves and swell? why do tides vary so much between one place and another? what gives rise to ocean currents and where do they flow? how is it that on certain dates the Thames can be expected to overflow in London? In his account of the various movements of the sea, the author ranges far afield and draws his illustrations from Nova Scotia, China, the Pacific, the Mediterranean and home waters; but it is particularly with reference to our own coasts and harbours that he tells the story behind wave, tide and ocean current.

The book has the great merit of being readable. It is written in a simple, straightforward style and the facts of oceanography are made very palatable. It will be a useful addition to the school library.

H. R.

Water. The Yearbook of Agriculture 1955. United States Department of Agriculture. 13·5 × 23·5 cm. xiii + 751 pp. Washington D.C.: U.S. Government Printing Office. $2.

Among the annual publications of the United States Department of Agriculture in their *Yearbook* series, there have been some volumes which are of the greatest interest to geographers, for example *Climate and Man*, the volume for 1941, out of

print now for some years. Of less immediate value, although of interest in parts and to particular specialists, have been Yearbooks whose central themes have included soils, forest trees, grasses and animal diseases. All these are overshadowed by the Yearbook for 1955 entitled *Water*, a book of the highest importance in geographical studies and of equal standing and value with *Climate and Man*. *Water* is written primarily as a compendium of practical information on the use and mis-use of water as a vital national resource. Scarcity and excess of water alike bring worry, losses and hardship. Its control and conservation directly affect every individual in the nation in a way of which all should be positively aware. In this book there is a great deal of immediate geographical interest which is normally widely scattered through a complex and usually obscure bibliography, all too often tainted by journalistic exaggeration and sentimentality.

After a first section on the water needs of man, plants and animals, there are ten chapters on the sources of water, including amongst other subjects the hydrological cycle, river and well water, modern techniques of salt-water conversion and induced precipitation climatic cycles. The next section, "Water and our Soil," deals with land forms, erosion and sedimentation and soil water, and is followed by chapters on flood control and watershed management. This general physical basis covers the first 210 pages.

Amongst the next 36 chapters, which deal with considerations of water and vegetation in the contexts of forests, irrigation, crops, ranges and pastures and gardens, turf and orchards, there is an especially interesting essay by C. W. Thornthwaite and J. R. Mather on "The Water Budget" and its use in irrigation. Of the remaining sections, "Pure Water for Farms and Cities" has chapters on the problems of urban and industrial water shortages, pollution and the treatment of effluent. The concluding "Look to the Future" has five chapters on finance, legislation, responsibility, education and research. There are an appendix of tables and diagrams and a full index.

In the United States this very attractively bound and well-printed book has been very well received, and it should certainly be found alongside *Climate and Man* on the shelf and in active use, in as many school, university and reference libraries as possible in this country. It can be ordered from the U.S. Government Printing Office, Division of Public Documents, Washington 25, D.C.

A. D. W.

Ingenieure Bauen Die Welt. K. Krüger. 16·5 × 22·5 cm. 456 pp. Berlin: Safari-Verlag. 1956. DM. 19.80.

Professor Krüger of the Technical University of Berlin and chairman of the International Technogeographical Society writes for general engineering readers about the geographical background of the many engineering tasks of the world. Many of the facts cited and diagrams used will be unfamiliar to geographers, and his summary in the concluding pages of geographical realities for engineers is stimulating. The 137 full-page photographs of engineering achievements are mainly of a type not often seen in English books and are well worthy of study. This is one of those books written by a non-geographer from which a geographer can extend the range of his interest and subject-matter. The style and language should not be too difficult for a reader with a moderate knowledge of German.

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